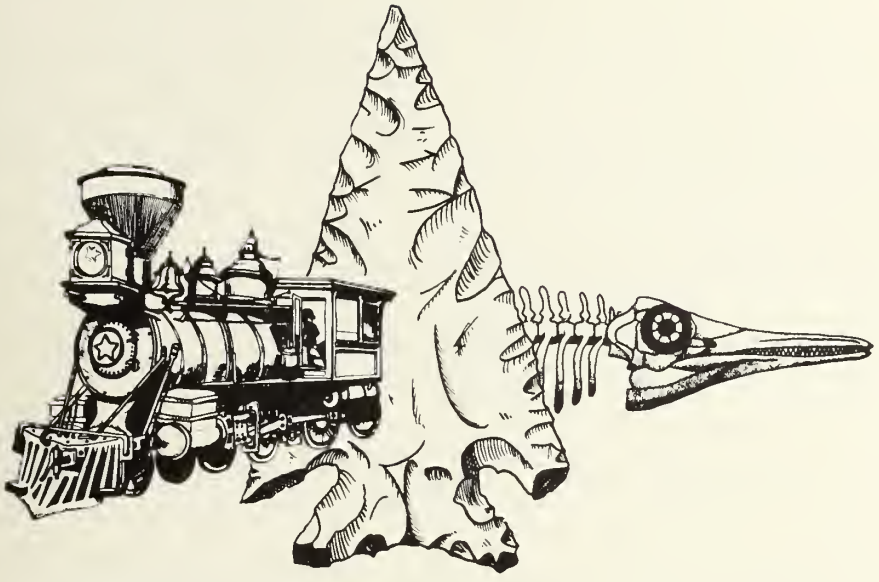
ND MANAGEMENT



Current Status of CRM Archaeology in the Great Basin

C. Melvin Aikens, Editor

CULTURAL RESOURCE SERIES No. 9
1986

BUREAU OF LAND MANAGEMENT
NEVADA

CULTURAL RESOURCES SERIES

* No. 1 The Pony Express in Central Nevada: Archaeological and Documentary Perspectives. Donald L. Hardesty (1979). 175 pp.

* No. 2 A Cultural Resources Overview of the Carson & Humboldt Sinks, Nevada. James C. Bard, Colin I. Busby and John M. Findlay (1981). 214 pp.

* No. 3 Prehistory, Ethnohistory, and History of Eastern Nevada: A Cultural Resources Summary of the Elko and Ely Districts. Steven R. James (1981). 387 pp.

* No. 4 History of Central Nevada: An Overview of the Battle Mountain District. Martha H. Bowers and Hans Muessig (1982). 209 pp.

* No. 5 Cultural Resources Overview Carson City District, West Central Nevada. Lorann S.A. Pendleton, Alvin McLane and David Hurst Thomas (1982). Part 1, 306 pp., Part 2, tables.

* No. 6 Prehistory and History of the Winnemucca District: A Cultural Resources Literature Overview. Regina C. Smith, Peggy McGuckian Jones, John R. Roney and Kathryn E. Pedrick (1983). 196 pp.

* No. 7 Nuvagantu: Nevada Indians Comment on the Intermountain Power Project. Richard W. Stoffle and Henry F. Dobyns (1983). 279 pp.

No. 8 Archaeological Data Recovery Associated with the Mt. Hope Project, Eureka County, Nevada. Charles D. Zeier (1985). 298 pp.

No. 9 Current Status of CRM Archaeology in the Great Basin. C. Melvin Aikens, Editor (1986). 205 pp.

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Reno, Nevada 89520

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Cultural Resource Series

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FOREWORD

"What contributions has Cultural Resource Management made to our knowledge of prehistoric and historic lifeways and events?" This question has been asked repeatedly in the archaeological profession; especially during the past decade when so much money, time and effort has been directed into public archaeology away from the university/museum oriented research. The Society for American Archaeology recently examined the status of work performed under national and state mandates in a series of regional conferences. This volume contains the results of the Great Basin conference committee's efforts.

The legal mandates emphasize preservation of information concerning the Nation's heritage, not solely protection of things and locations. Consequently, the expertise required transcends the technician field to that of the expertise of a professional anthropologist and historian. Complexities of adequately guiding projects and programs to attain these goals cannot be underestimated.

Given more than a decade since Federal CRM programs have become fully implemented, how have they responded to this directive? How well have contractors responded? Where are efforts least effective? In what instances are these efforts contributing to our knowledge? How effectively is this knowledge being preserved? Where should efforts be scaled back and where should emphasis be increased? The conference members essentially addressed these questions and more through inspecting the various facets of CRM (data accumulation, data storage, field approaches, personnel standards, laboratory and curation practices, information sharing, and use of information from related fields, among other topics). The goal of this assessment, as it should be, is to enhance the prospect that the limited public funds are spent in a productive manner and professional careers are not consumed in vain. If the answers are not as clear as you would wish to see, in most cases they may be readily constructed from the information and assessments provided.

Most lands in the Great Basin are managed by the BLM and most of that in Nevada. Therefore, we are pleased to make this information available to the public and for professionals to use in their own assessments of their efforts.

Richard C. Hanes
Bureau of Land Managment
Portland, Oregon

July, 1986

CURRENT STATUS OF CRM ARCHAEOLOGY IN THE GREAT BASIN

Report of the Society for American Archaeology
Regional Conference on Great Basin
Cultural Resource Management Research

by

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C. Melvin Aikens, Editor

1986

CURRENT STATUS OF CRM ARCHAEOLOGY IN THE GREAT BASIN

Report of the Society for American Archaeology
Regional Conference on Great Basin
Cultural Resource Management Research

PREFACE

In 1983 the Society for American Archaeology (SAA) initiated a series of get-togethers with members of the joint committee on environmental issues of the American Mining Congress and the National Coal Association. These informal meetings, held in Denver, Colorado and Reno, Nevada, came about primarily at the initiative of Gregory Conrad of the American Mining Congress, William Hynan of the National Coal Association and Cynthia Irwin-Williams, a Past-President of the Society for American Archaeology. The immediate focus was the impact of coal strip mining on cultural resources, and the need to properly address cultural resources concerns in mining lease areas. After several highly productive meetings between the mining industry joint committee and an ad hoc SAA committee appointed by then President George Frison, it was concluded that a series of regional conferences would be useful. Further, it was clear that the scope of the conferences should be quite broad: to determine the status of the data base in each region and to evaluate how CRM archaeology is being conducted in each region. Eleven regions were designated within the forty-nine continental states, chairs of conferences picked, and the conferences were held in late 1984 and early 1985. A session on conference results was held at the May, 1985 annual meeting of the Society for American Archaeology in Denver, Colorado. Arrangements were made to publish an overall summary volume to be issued by the Society, and larger volumes for each region.

The present volume contains conference findings for the Great Basin. It represents a great deal of hard work by the conference participants and many others who contributed data, ideas, and support. It is a particular pleasure to note that this volume is among the first of the general volumes to appear. It clearly is a significant addition to Great Basin CRM and Great Basin archaeology in general. We offer our congratulations and deep appreciation to conference chair and editor, C. Melvin Aikens, and all his hard working conferees.

Don D. Fowler, President, SAA

Cynthia Irwin-Williams, Chair,
SAA Regional Conference Committee,

Reno, Nevada
June 25, 1986

ACKNOWLEDGMENTS

The regional conference described here, and especially the production of this report, was greatly facilitated by a matching grant made to the University of Oregon by the State of Nevada, Division of Historic Preservation and Archaeology (Project #32-84-8711-B[11], Great Basin Regional Planning Conference). This support was crucial, and very much appreciated.

Funding for the travel expenses of the conference participants came variously from the pockets of the participants themselves, and from their respective institutions. Needs for support during the writing of the papers that make up this report were met in the same way. These indispensable contributions are most gratefully acknowledged.

The Desert Research Institute, University of Nevada System, provided excellent meeting facilities for the use of the conference working group. Thanks are extended to Cynthia Irwin-Williams, Executive Director of the Social Sciences Center, for making this possible.

The master for this volume was created with dispatch by Joann Brady. Marie G. Raisz graciously gave permission to use, without charge, Irwin Raisz's classic physiographic diagram of the Western United States as a base for the maps contained herein. The overlays which adapt Raisz's work to the purposes of this report are the skilled work of Peter Eberhardt.

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PART I

INTRODUCTION

Fig. 1. Map of the Great Basin, showing Regional Subdivisions.

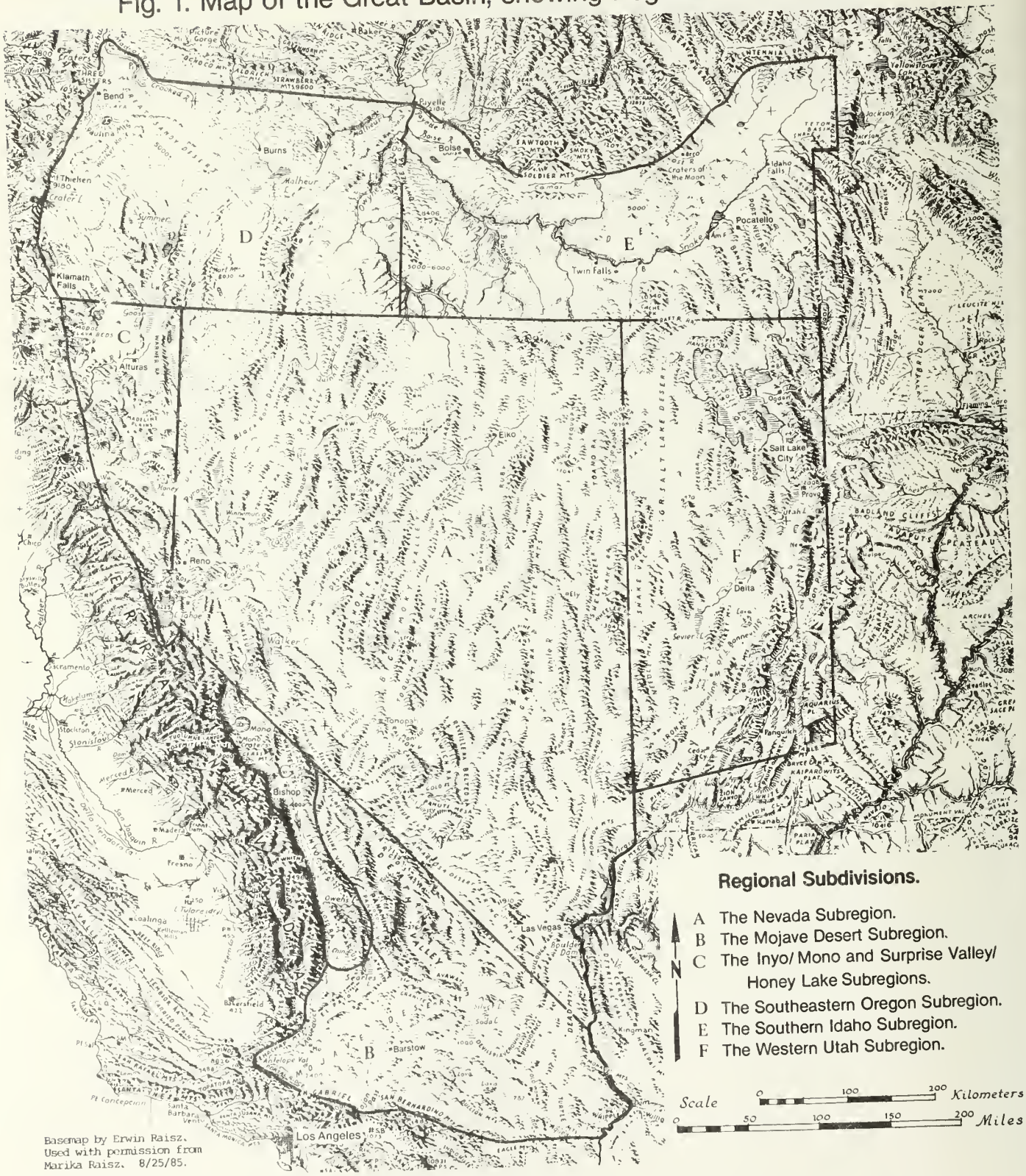

Fig. 1. Map of the Great Basin, showing Regional Subdivisions.

THE SAA REGIONAL CONFERENCE ON GREAT BASIN CRM ARCHAEOLOGY

by

C. Melvin Aikens

The stock-taking reported in this volume was initiated during a February 1-3, 1984 meeting convened by Don D. Fowler (then President-elect) and Cynthia Irwin-Williams (Past President) of the Society for American Archaeology. Also present, among others, was George C. Frison, then current President of the Society. The involvement of these three leaders highlights the importance attached by the SAA to the matters at hand. The group met in Reno, Nevada. One of the principal items of business at that meeting was the planning of a series of regional conferences centered on the conduct of contract archaeological research. A small selection of SAA members from all over the United States had been invited; they were asked to organize and chair small working groups that would assess the status of regional cultural resource management research in archaeology, and the regional application of national standards and guidelines.

An outline of the subject areas to be addressed at all the projected regional conferences was hammered out at the Reno meeting. It was agreed that the regional working groups must be kept small, so that--in terms of interpersonal dynamics--they would actually work. It was further agreed that the best approach to recruiting scholars with the necessary knowledge and conviction would be to advertise for volunteers through normal professional channels within each region. The need for people of conviction, clear in any case, was heightened by the fact that all who served would have to do so at their own expense.

The privilege (and it was that) of chairing the regional conference for the Great Basin fell to me. Those who responded to the call for volunteers were people who knew their duty. We met for two exhilarating days, December 3-4, 1984, as guests of Cynthia Irwin-Williams at the Desert Research Institute in Reno. The participants came bearing drafts of papers earlier assigned on the basis of the master regional conference agenda. These were presented, discussed, and negotiated; revisions and amendments were agreed on, and additional writing assignments were shared around. All departed Reno in a state of utter exhaustion, with more work to do. No one on the squad had won the Mercedes-Benz from the big dollar slot machine at the Nugget Casino, but all felt a certain amount of satisfaction over difficult yardage gained.

We offer here the results of this process. Our report is faithful to the basic approach and content outline devised for all the regional conferences at the February 1984 meeting, with only minor adjustments. It consists of parts: Introduction, Current Status of the Regional Data Base, Conduct of CRM Archaeology in the Regional Context, and Summary and Conclusions.

The introductory and concluding chapters are routine, requiring no particular comment. Six of the eight chapters which inventory the regional

data base are all written to the same basic outline, though they inevitably differ to a degree in both form and content. Topics include definition of subregions; current status of state plan development; location, content, and accessibility of site records; nature and extent of survey coverage; collection and curation policies; data on contemporary and prehistoric environments; historical archaeology; photographic and archival records; availability of data summaries and syntheses; research priorities; potentials for predictive modeling; regional planning; communication with Native Americans; and, finally, bibliographic resources. The subregional divisions in terms of which they are organized have a certain amount of cultural meaning, though they also reflect administrative realities and/or the "turfs" of the individual authors (Fig. 1). Chapters on the current status of an expanding computerized data base and on paleoenvironmental modeling and geoarchaeology complete this section.

The chapters which treat the conduct of CRM archaeology in the Great Basin context describe the current state of affairs in areas of critical research and management importance. Throughout, the presentations are concerned with identifying both successes and persistent problems. Probably more than in any other part of the United States south of Alaska, CRM in the Great Basin has brought about a major expansion of archaeological activity. Most of the land there being in Federal ownership, agency mandates foster a great deal of survey work and a significant amount of excavation. Archaeology in the Great Basin states is highly visible and an important concern to many besides archaeologists themselves. Manifestly, it is crucial that the profession exercise vigilance over the standards applied to archaeological research there.

PART II

CURRENT STATUS OF THE REGIONAL DATA BASE

Fig. 1. The Nevada Subregion.

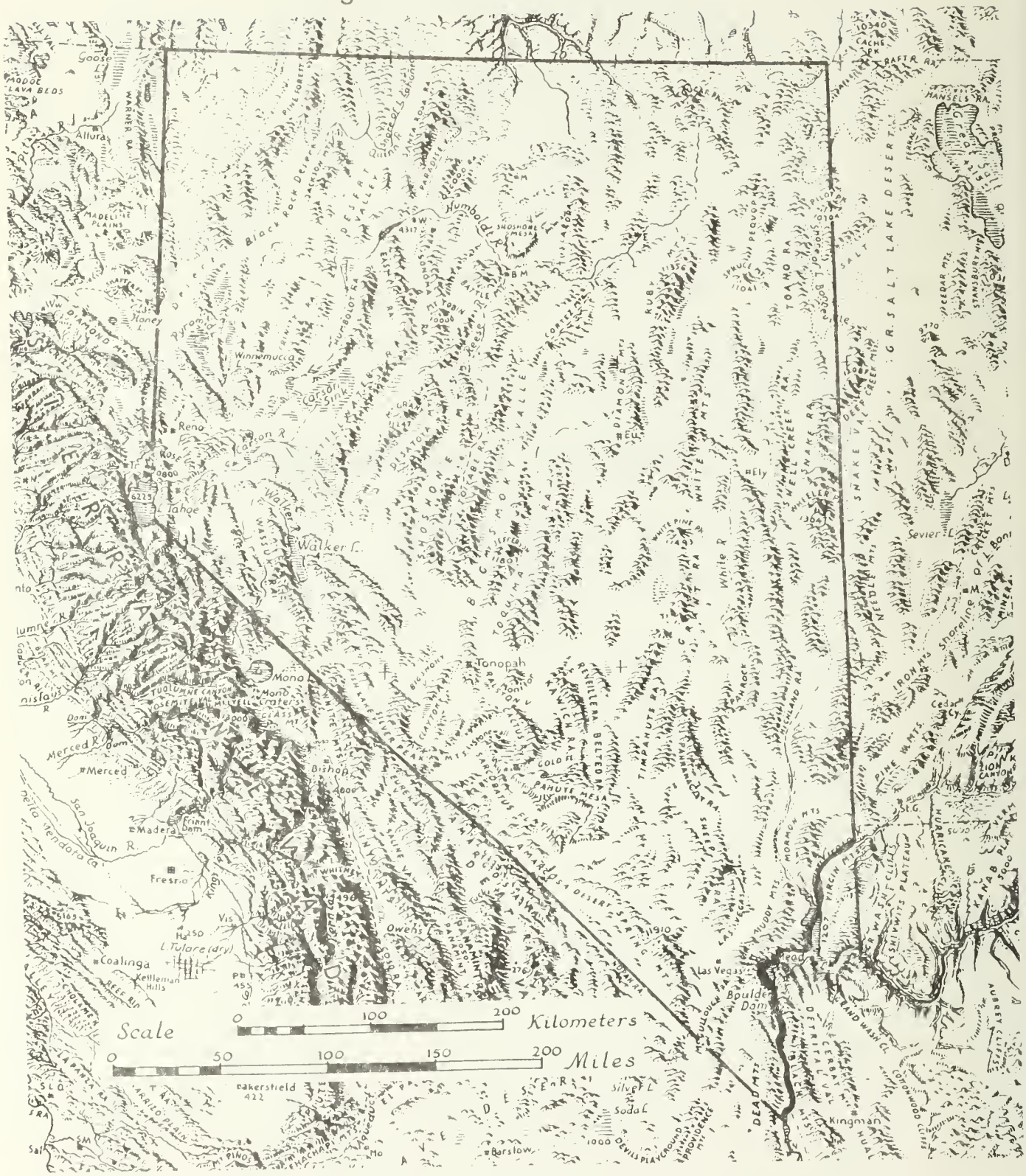

Fig. 1. The Nevada Subregion.

NEVADA

by

Alice M. Becker

The Subregion

Nevada can be divided into five major units on the basis of hydrology and, to a lesser extent, vegetation and geography (State of Nevada Division of Water Resources, Water Basin and Inter-Basin Flows Map, 1971). These are the Humboldt River Basin and western, northern, central, and southern Nevada units. These broadly defined subdivisions became the basis for prehistoric study units within the Nevada State Plan (Fig. 1).

The southern Nevada unit differs most radically from all the others. Much of southern Nevada is drained by the Colorado River rather than solely through interior drainage systems. The valley floors are lower than valleys in the northern part of the state, generally 2500 feet or less. Vegetation differs substantially with the creosote bush community dominating and Mojave Desert plant species providing a variety of food sources not available in the north (Lyneis 1982:161).

The other units are more difficult to distinguish. The Humboldt River and its tributaries, an interior drainage and Nevada's major river, drain nearly 15% of the State. The stream and river banks of this system provided riparian resources attractive to prehistoric populations. Eastern Nevada is not sharply defined by vegetational or cultural boundaries from other units. Most mountain ranges contain limestone strata but the boundary with adjoining units is not readily discerned. Central Nevada is distinguished by the presence of enclosed drainage basins of which most valley floors exceed 5000 feet in elevation. Western Nevada is characterized by the presence of permanent lakes fed by streams and rivers originating in the Sierra Nevada. Northern Nevada drainages contribute to the Snake River system; much of extreme northern Nevada is volcanic tableland geologically similar to the Columbia Plateau.

At the time of Anglo-European contact, Numic speaking peoples--the Northern Paiute, Shoshone, and Southern Paiute--occupied what is now Nevada, with the exception of a small portion of extreme western Nevada. That area was inhabited by the Washo, members of the Hokan language group unrelated to the Numics. The people were hunters and gatherers, depending on plant foraging supplemented by hunting and fishing. Groups of independent families were self-sufficient economic units which traveled together to resource areas as they became seasonally available (Steward 1938:232).

Archaeological evidence from all study units points to a lengthy period of Desert Archaic hunting and gathering, with spatial and temporal variations, prior to the appearance of Numic speaking peoples. Two exceptions relate to brief periods of occupation by horticulturists. In eastern Nevada, a change in material culture and subsistence occurred between A.D.

500 and A.D. 1200-1300 with the appearance of the Fremont culture. In the south, from approximately 300 B.C. to A.D. 1150, the Virgin Branch Anasazi left a record of horticultural subsistence similar to patterns prevalent in the southwestern United States.

State Plan

The first Nevada historic preservation plan was prepared in 1978 by Charles Hall Page and Associates, an architectural firm based in California. The plan described agencies and programs engaged in historic preservation and proposed management goals for preservation in Nevada. The emphasis was on historical themes and the plan did not address archeological needs.

The current Archaeological Element for the Nevada Historic Preservation Plan was completed in 1982. The plan was a team effort, contributions being made by agency, contract, and university archaeologists in Nevada. Individuals met at a workshop session in accordance with Resource Protection Planning Process (RP-3) guidelines to determine and discuss key research issues within each of the study units (Table I).

In addition to the five subregions defined by hydrology, other units in prehistory were identified as important problem areas because the subject matter transcended all of the previously defined units. The team identified the following research domains that are the basis of research problems in the study units: spatial and temporal variability of settlement patterns and human subsistence, environmental change, trade and exchange, belief systems and ideology, and long-term directional change in the Archaic. The team also agreed that lithic analysis should be considered an important methodological research domain (Lyneis 1982:13).

Drafts of the study units were forwarded to a review team composed of archeologists with long-standing commitment to research in the Great Basin. Margaret Lyneis coordinated the development of the plan, edited the drafts, and had the resulting document printed and distributed.

The identification of themes and problems in Nevada archeology was achieved through the cooperative efforts of a majority of archeologists, academic as well as those representing management groups. The plan satisfies RP-3 goals through the identification of the kinds of sites that will answer important research questions, justifying their preservation or data recovery.

The plan has weaknesses due in part to the team approach in preparation; other flaws are caused by problems in the RP-3 process. The quality of writing varies and there remains too much disparity between units. Not all of the units were completed: the western and northern Nevada, rock art, and early occupation man units await future efforts. The plan already requires updating to incorporate the results of recent archeological fieldwork. Operational plans for each unit must still be developed. The Nevada Council of Professional Archaeologists has volunteered to undertake this task. Additionally, a subregional plan for Moapa Valley in southern

Table I. Archaeological Element of the Nevada State Historic Preservation Plan: An Outline

Regional Prehistoric Study Units	Research domains - prehistoric themes of importance to be examined in each unit.
Western (not completed)	- spatial and temporal variability of settlement patterns and human subsistence.
Central	
Southern	- environmental change.
- Moapa Valley (subunit)	- trade and exchange.
Northern	- belief patterns and ideology.
Humboldt River Basin	- long-term directional change during the Archaic.
Study Unit:	Research domains - historic themes.
Historic Archeology	- farming and ranching.
	- industrialization.
	- Mormon colonization.
	- urbanization.
Other study units of importance identified by workshop participants:	- rock art
	- Earth surface features
	- roasting pits
	- early occupation

Nevada was recently completed (Rusco 1983) in response to needs created by the rapid deterioration and destruction of resources in the area due to vandalism.

Another problem is shared with other states which have completed State Plans. Who will use the plan and for whom should the plan be written? The National Park Service would prefer to see planners and managers--nonarcheologists--use state plans to make decisions about the significance and disposition of cultural resources. But in Nevada, where the plan has been widely distributed, agencies (happily) still tend to rely on interpretation of the document by agency and consultant archeologists.

Agencies do not seem to be using the plan. Federal agencies, such as the BLM and U.S. Forest Service, use their own systems to evaluate historic properties, and these do not always coincide with the federal system or the state plan. BLM, for example, still employs its own rating system. Some archeologists still evaluate on the basis of site size, site frequency, or other factors. The SHPO continually must request agency archeologists to refer to the State Plan in making determinations of eligibility, and compel consultants to make research questions from the Plan a part of their data recovery plans.

The research questions for each unit are vague and general, a complaint made of other State Plans as well. Often it is difficult to judge whether sites discovered during surveys have the potential to answer key research questions. Nevada, in particular, presents a problem in site evaluation: most sites are lithic scatters and their value to research is hard to evaluate upon first recording. The cost of collecting and analyzing the contents of lithic scatters is so high that many contract and agency archeologists simply record the presence of large, complex scatters and recommend their avoidance, contributing to a continued ignorance of their research potential.

Sources of Existing Records

Site Records and Locations

The Nevada State Museum Annex at 1000 Topsy Lane, Carson City 89701, is the central repository for all archeological site records in Nevada. The Annex is open five days a week, Monday through Friday, 9:00 A.M. to 4:00 P.M., but arrangements to use the files must be made at least 24 hours in advance by telephone (702) 885-3002. A $25 fee plus costs for staff time and copying are assessed users. Other information on use of the Museum files can be found in the Handbook of Nevada Antiquities Law (Tuohy 1982). Museum site reports and site forms are currently maintained in file cabinets. Indexing on the Museum computer is being initiated. The locations of projects and sites are plotted on USGS quadrangle maps. Smithsonian site numbers are assigned by Museum staff.

Nevada State Museum files are not current for all counties. When working on Federally managed land, archeologists should consult with the BLM district offices (see Table II), which maintain current information on site location, previous surveys conducted, and projects located on BLM land.

Site files for southern Nevada (Clark, Esmeralda, Lincoln, and Nye Counties) are maintained at the Natural History Museum at the University of Nevada-Las Vegas (UNLV), 4505 Maryland Parkway, Las Vegas, Nevada 89154, telephone (702) 739-3743. The Museum is open five days a week, Monday through Friday, from 8:00 A.M. to 4:00 P.M. The fee structure is similar to that of the Nevada State Museum, at $25 plus staff time and copying costs. Users are urged to call for appointments since Museum staff members spend time in the field.

Table II. Bureau of Land Management District and Area Offices

Battle Mountain District
P. O. Box 194
Battle Mountain, NV 89820
(702) 635-5181

Carson City District
1535 Hot Springs Rd., Suite 300
Carson City, NV 89701
(702) 882-1631

Elko District
P. O. Box 831
Elko, NV 89801
(702) 738-4071

Ely District
Star Route 5, Box 1
Ely, NV 89301
(702) 289-4865

Las Vegas District
4765 West Vegas Avenue
Box 5400
Las Vegas, NV 89102
(702) 388-6403

Stateline Resource Area
(part of the Las Vegas District)
P. O. Box 7384
Las Vegas, NV 89125
(702) 388-6627

Susanville District
P. O. Box 1090
Susanville, CA 96130
(916) 257-5385

Tonopah Resource Area
P. O. Box 911
Tonopah, NV 89049
(702) 482-6214

Winnemucca District
705 East 4th Street
Winnemucca, NV 89445
(702) 623-3676

The State Historic Preservation Office, 201 South Fall Street, Room 106, Carson City, Nevada 89710, telephone (702) 885-5138, reviews cultural resource reports as they are completed, then forwards them to the Nevada State Museum. A 3 to 12 month backlog of reports exists at the office.

The SHPO also has maps and records, but they are not up-to-date, with the exception of files maintained for sites (both archeological and structural) listed on the National Register of Historic Places. Site forms for buildings and other historic structures inventoried in the State are kept in three-ring binders in the office, but are not plotted on maps and are not numbered, nor formally organized. An index of historic records on hand has been initiated.

Historic archeological sites are recorded on modified IMACS site forms (see Lichty, this volume). Historic sites are not distinguished from prehistoric sites on maps, nor by assigned site numbers; historic site reports are filed with prehistoric records. These records are accessible at the same locations noted above.

Cultural resource collections are maintained at several major facilities in the State of Nevada. Nevada Revised Statutes (NRS) 381.207 requires that fifty percent (50%) of all artifacts recovered by permit holders be curated at the Nevada State Museum. Although federal agencies are not bound by state law, some try to ensure that collections are curated

in qualified Nevada facilities, to aid future research. The BLM, for example, which is the major federal land manager in the State, has entered into a curatorial agreement with the Nevada State Museum. However, the U.S. Forest Service sends collected artifacts to Weber State University in Ogden, Utah, and some collections are temporarily housed at the American Museum of Natural History for study. Additionally, prior to the development of a strong CRM program in the BLM and before federal preservation legislation was passed, many large collections were taken to facilities at the University of California at Berkeley and Davis. Table III provides specific addresses of institutions maintaining major Nevada CRM collections. Table IV includes information regarding specific ethnographic collections from Nevada located around the country.

A large collection of photographs from the historic period is curated at the Nevada Historical Society in Reno. It has been partially indexed. Microfiche and film records of Nevada newspapers are also available. At the Historical Society, the Territorial Enterprise is indexed up to 1880 and five Reno newspapers are indexed up to 1876. At UNLV, the Pioche Record is indexed from 1872 to 1905, and the Las Vegas Review and Las Vegas Age well into the 1940s. The UNLV Special Collections Library is in the process of obtaining historic southern Nevada photographs. Special Collections both at UNLV and University of Nevada-Reno (UNR) contain the papers of past Nevada notables--particularly politicians, and rare Nevada publications. The UNR Department of Oral History is another good source of historic information. An index of oral histories recorded and on file is available to the public. The Government Publications section at UNR contains most reports to the U.S. Congress on the 19th century government surveys of Nevada. The Desert Research Institute in Reno maintains a Frederick West Lander collection which includes letters and articles on his wagon-building expedition in Nevada.

Survey Data

Over 90% of the archeological surveys conducted in Nevada are generated as a result of federal action. Because 87% of Nevada is federally managed, mainly by BLM, most survey work is conducted following the Cultural Resources Survey: General Guidelines (1982) developed by BLM and SHPO archeologists. The U.S. Forest Service and Department of Energy operate under similar procedures.

Almost all surveys performed for small projects are of the intensive Class III variety described in the guidelines, in which 100% of an area is examined for cultural resources. For larger projects, Class III's are also recommended unless there are special circumstances: previous land disturbance, steep slopes, poor surface visibility, etc. In that case, Class II surveys are conducted in which an area is sampled based on previously existing information such as location of significant known sites, geomorphology, soil maps, and hydrology. Random transects are selected as well to test the validity of the stratified sample. Occasionally, Class II surveys are used to predict the location of significant archeological sites or areas of high site frequency for planning purposes. However, their use in planning the placement of transmission lines or other projects is limited as other environmental or economic factors weigh more heavily on these cases.

Table III. Major Curatorial Facilities for Nevada

In the Great Basin:

Nevada State Museum
Carson City (extensions in
Overton and Las Vegas)
Fee: $1080/cubic foot
Donald R. Tuohy, Director
(702) 885-4810
Accepts CRM collections.

Museum of Anthropology
University of Nevada-Reno
Fee: $300/cubic foot negotiable
Donald Hardesty or Catherine Fowler
(702) 784-6704
Accepts CRM collections under
special circumstances.

Cultural Resource Evaluation
Center - Weber State University
324 - 25th Street
Ogden, UT 84401
Collection of USFS artifacts.

Museum of Natural History
University of Nevada-Las Vegas
Fee: $1380/cubic foot
Kevin Rafferty, Director
(702) 239-3590
Accepts CRM collections.

Desert Research Institute-Reno
Fee: negotiable
Cynthia Irwin-Williams, Director
(702) 672-7302
Accepts CRM collections under
special circumstances.

University of Utah
Department of Anthropology
117 Stewart Building
Salt Lake City, UT 84112
(801) 581-6251
Collection of Ruby Valley
artifacts.

Outside the Great Basin:

American Museum of Natural History
Central Park West at 79th Street
New York, NY 10024
(212) 873-1300
Collection of Mt. Jefferson and
Gatecliff artifacts.

University of California at
Los Angeles
Department of Anthropology
Los Angeles, CA 90024
(213) 825-2511

Adan Treganza Anthropology Museum
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132
(415) 469-1642

University of California, Davis
Department of Anthropology
Davis, CA 95616
(916) 752-0745

University of California, Berkeley
Lowie Museum
Berkeley, CA 94720
(415) 642-3391

Historical facilities:

Southern Nevada State Museum and
Historical Society
700 Twin Lakes Drive
Las Vegas, NV 89107
(702) 385-0115

Special Collections Department
James Dickinson Library
University of Nevada-Las Vegas
4505 South Maryland Parkway
Las Vegas, NV 89105
(702) 739-3252

Table III (continued)

Oral History Program
Getchell Library
University of Nevada-Reno
Reno, NV 89557
(702) 784-6932

Government Publications
Getchell Library
University of Nevada-Reno
Reno, NV 89557
(702) 784-6579

Special Collections
Getchell Library
University of Nevada-Reno
Reno, NV 89557
(702) 784-6538

The BLM currently permits the collection of artifacts under special circumstances without prior permission from BLM or SHPO. These circumstances include: when site integrity is threatened by project-related activities or when there is a serious short-term threat due to natural processes or illegal collection. Sites at which this is permitted include small (less than 20 artifacts) or large nondescript sites and small sites with spatial patterning. The Forest Service has a similar policy. SHPO discourages other agencies from wholesale collecting of sites which have not been evaluated and for which data recovery plans with required reports have not been scheduled.

Little survey work is conducted on state and private land; much of the land has been disturbed by development. Yet when federal undertakings, such as FHWA interstate construction, involve these lands--which contain most of the water and the best soils in the State--highly significant stratified sites are discovered which add much to the data base.

Therefore, desert valleys in central Nevada are better sampled than river basins which have been historically settled and privately owned for 100 years or more. The bias of sampling only in project-related areas skews the archeologist's interpretation of prehistory and future archeological expectations. Most CRM surveys have occurred on valley floors in response to seismic testing, in canyons along ore bodies, and at spring locales prior to development. Perhaps archeologists should not be surprised at the discovery of an Alta Toquima and should expect similar discoveries as other mountain ridges and peaks above the tree line are examined.

Mountainous areas of Nevada managed by the U.S. Forest Service and secondarily the BLM remain largely unknown despite Thomas' well publicized work in the Toquima Range (Thomas 1983a; 1983b). The SHPO has noted these gaps when asked to comment on the proposed wilderness designation of over one million acres of BLM land and 400,000 acres of Forest Service land. However, inaccessible mountain ranges are not the only neglected areas of the State. Prior to the Air Force's interest in placing the MX project in central-eastern Nevada, very little had been recorded in valleys whose names were unknown to most archeologists.

Table IV. Location of Ethnographic Collections

In-State facilities:

Lost City Museum
P. O. Box 807
Overton, NV 89040
(702) 397-2193

Nevada State Museum
600 North Carson Street
Carson City, NV 89710
(702) 885-4810

Nevada Historical Society
1650 N. Virginia Street
Reno, NV 89503
(702) 789-0190

Out-of-State facilities:

Peabody Museum of Archaeology and Ethnology
11 Divinity Avenue
Cambridge, MA 02138
(617) 495-2248
(Palmer, Park, Kelly, and Steward Collections)

Utah Museum of Natural History
University of Utah
Salt Lake City, UT 84112
(801) 581-6927
(Malouf and Steward Collections)

Museum of New Mexico
113 Lincoln Avenue
Santa Fe, NM 87503
(505) 827-6450
(Kelly Collection)

Smithsonian Institution
1000 Jefferson Drive, S.W.
Washington, D.C. 20560
(202) 357-1300
(Powell and Magee Collections)

Robert H. Lowie Museum of Anthropology
103 Kroeber Hall
University of California
Berkeley, CA 94720
(415) 642-3681
(Kelly, Park, and Steward Collections)

American Museum of Natural History
79th & Central Park West
New York, NY 10024
(212) 873-1300
(Lowie, Kelly, and Park Collections)

Milwaukee Public Museum
800 West Wells Street
Milwaukee, WI 53233
(414) 278-2702
(Barrett Collection)

Museum of the American Indian
Heye Foundation
Broadway at 155th Street
New York, NY 10032
(212) 283-2420
(Harrington Collection)

Southwest Museum
234 Museum Drive
Los Angeles, CA 90042
(213) 221-2164
(Harrington Collection)

Conversely, archeologists have a great deal of information for certain areas of the State, although frustratingly little has been done in the way of syntheses. Interstate highway projects have resulted in major excavations in and around Reno (Elston 1979; Miller and Elston 1979; Elston and Turner 1977; James et al. 1982; Matranga and Rodman 1983), which should

result in a major reevaluation of prehistory in the Truckee Meadows area. Las Vegas Valley has been under scrutiny for at least twenty years, although the published results are disappointingly few (Lyneis et al. 1979; Rafferty 1984). Large tracts of Railroad Valley and Long Valley in central and eastern Nevada have been surveyed prior to seismic testing; Dixie Valley in the west has been subject to many surveys due to drilling of geothermal test wells; Big Smoky Valley in central Nevada has been sampled prior to desert land entries. The Division of Historic Preservation and Archaeology would encourage future thesis or intern work centering on the synthesis of the existing data in each valley, testing current models of settlement patterns. The Humboldt River Valley has also been the setting of major excavations at Valmy (Elston et al. 1981), Carlin (Rusco et al. 1979a), and Rye Patch Reservoir (Rusco et al. 1979b).

Sensitivity mapping has been used to a limited extent. Most archeologists have been cautious about preparing such maps where they do not feel sampling or existing information is adequate. Lyneis et al. (1979) developed one for the City of Las Vegas to aid planners. However, within three years, city growth had outstripped the boundaries of her project area and planners and archeologists could no longer use the map to justify archeological surveys or the necessity of monitoring excavation in many cases.

Sensitivity maps, delineating areas where archeological sites are likely to be located, are useful in a limited way in Nevada if enough data are available. But even with map in hand, planners in the Reno area, for example, would have nowhere to direct growth in the crowded basin; in other areas of the State, there is no control over growth, so sensitive areas are likely to be disturbed anyway. The Division has noted that planners, for the most part, want maps that inform them of areas that are "cleared" or where archeological surveys are not needed. Therefore, most planning departments have not been enthusiastic about funding the development of sensitivity maps.

Environmental Data/Spatial Maps and Air Photos

The Nevada Resource Action Council has published an index of Nevada maps and aerial photographs (1980) and the reader is referred to this index for more detailed information than that presented here.

The U.S. Geological Survey has not mapped the entire State of Nevada in 7.5 and 15 minute quadrangles. Maps of those areas surveyed are available through the Nevada Bureau of Mines and Geology (NBMG) at UNR. The NBMG also serves as a center for information on air photos.

The Agricultural Stabilization and Conservation Service (ASCS) has aerial photography coverage of most privately owned agricultural land in Nevada. The Bureau of Land Management has air photographs available at the State and district offices; the color photographs date from 1976 to 1979 and the black and white large-scale photographs date from 1965 to 1970. Other aerial photographs are also available. Air photographs are available for all U.S. Forest Service lands in the State, although those for the

Humboldt National Forest (in the eastern part of the State) are almost twenty years old.

The BLM has one inch to the mile 30 minute quadrangle survey maps for all of Nevada. Each BLM district office and the State office maintain sets of land status maps which distinguish between public and private land in and around BLM holdings. The BLM also publishes a yearly Public Land Statistics bulletin (U.S. Department of Interior 1983) which serves as a useful reference.

Geology and Soils

The Nevada Bureau of Mines and Geology at UNR is a center of information on Nevada's geology and mineral resources. Mining is an important industry in the State, so much information has been amassed and much of Nevada characterized and mapped (Stewart and Carlson 1977; Stewart 1980; Hose and Blake 1976; and others). NBMG is an important source of information on historic mining districts.

The Soil Conservation Service (SCS) has published soil surveys and maps of areas around the State. Soil surveys are being completed and published continuously, so indexes are quickly dated. The Nevada State Office of the SCS should be contacted regarding inquiries on specific areas of the State.

A bibliography of caves has been written by McLane (1974) and is available through the Desert Research Institute in Reno. Piegat (1980) should be consulted regarding information on glacial geology in Nevada.

Hydrology

The Division of Water Resources, State of Nevada, has published reports on ground water sources for Nevada's seventy designated ground water basins (i.e., Glancy and Katzer 1975; CNR 1965). The Division of Water Planning, State of Nevada, has prepared a useful pamphlet (Department of Conservation and Natural Resources 1980) with facts on each hydrologic basin: for example, number and miles of streams per basin, number of lakes, acre feet in lakes, and so on. The Water Resources Center of the Desert Research Institute is another source of project-related reports on hydrology in the State.

Climate

Nevada's Weather and Climate (Houghton et al. 1975) is the best reference for the area. Kay (1982) has written a thoughtful essay on the potential for determining paleoclimate variations.

Vegetation

The basic reference is Intermountain Flora, Vascular Plants of the Intermountain West (Cronquist et al. 1972). Smaller geographic areas, such as the Sheldon Antelope Range in northern Nevada (Rogers and Tiehm 1979) and southern Nevada (Bradley and Deacon 1967; Beatley 1976), have

received special attention. Lanner (1981) focuses on one species, the pinyon pine. Young, Evans, and Tueller (1976) and Rogers (1982) have conducted research on vegetational changes during the historic period, focusing on the encroachment of pinyon into sagebrush vegetation zones. The Sierra Nevada Natural History (Storer and Usinger 1963) is a good guide to vegetation (and animals) on the eastern Sierra Nevada front.

Animals

Hall's Mammals of Nevada (1946), although out-of-print, is still widely used. Also, see Hubbs et al. (1948). Burt and Grossenheider (1964) provide a rather generalized guide of mammals in North America. The best information on mammals, particularly game species, can be obtained from the Nevada Department of Wildlife (NDOW) which maintains records on the distribution of fauna, particularly game animals and their migration routes. NDOW is also responsible for the preparation and publishing of good reports on the mountain lion (Ashman et al. 1983), bighorn sheep (McQuivey 1978), and pronghorn antelope (Tsukamoto 1983).

Ryser's Birds of the Great Basin (1985) is the best guide available and includes information on water fowl. This publication includes summaries for each species and some illustrations. A book on raptors by Herron is due out shortly. Peterson's Guide to Western Birds (1969) is still useful because of its fine illustrations. Another, rather dated, publication by Lindsdale (1936) contains distributional information.

Stebins (1966) is the best source of basic information on reptiles and amphibians. LaRivers (1962) Fish and Fisheries of Nevada is still consulted. Hubbs et al. (1974) have worked on the problem of relict fish distribution in Nevada.

Environmental and Paleoenvironmental Data

Late Pleistocene and Holocene environmental change is a topic of importance in the Great Basin as most archeologists agree that there is some link between climatic and environmental change and long-term shifts in settlement and subsistence (Madsen and O'Connell 1982:5). However, archeologists lack substantive paleoenvironmental data needed to interpret Basin prehistory. Gaps in specific types of data in each geographic or hydrologic area likely will be filled slowly. Unfortunately, archeologists, particularly in cultural resource management, will continue to look at existing flora and fauna to make inferences regarding Holocene adaptations. As Lyneis points out (1982:20), paleoenvironmental research must be conducted in individual hydrographic basins for an understanding of past culture-environment relationships in Nevada.

Mehringer (1977) presents the most comprehensive summary of the late Quaternary environment in Nevada. Pippin (this volume) provides a guide to the paleoenvironmental and geoarchaeological literature published since Mehringer's review. Davis (1982) examines the Lahontan Basin, and Weide (1982) the southern Great Basin. Both of these papers appear in Man and Environment in the Great Basin (Madsen and O'Connell, editors, 1982). The reader is referred to these papers and their bibliographies for a comprehensive overview of paleoenvironmental research in Nevada.

Pollen sequences have been recorded in southern Nevada at Tule Springs (Mehringer 1967), Saratoga Springs and Ash Meadows in the Amargosa Desert (Mehringer and Warren 1976), and at the O'Malley Shelter (Madsen 1972). Madsen (1982a) collected pollen from the Saval Ranch and Thompson (1983) reports on pollen from the Ruby Marsh, both sites in northeastern Nevada. In Central Nevada, Gatecliff Rockshelter (Thompson and Kautz 1983) and Potato Canyon Bog (Madsen 1982b) have yielded pollen samples. Wigand and Mehringer (1985) analyzed pollen from Hidden Cave above the Carson Sink in western Nevada which interestingly does not demonstrate Holocene climatic fluctuation, unlike the results obtained from nearby Leonard Rockshelter located on the Humboldt Sink (Byrne, Busby, and Heizer 1979). The recent development of a pollen lab at the Desert Research Institute may increase the number of pollen studies in Nevada.

The reconstruction of Pleistocene/Holocene phytogeography through the study of C-14 dated Neotoma nests has been undertaken mostly in southern Nevada (Mehringer 1967; Mehringer and Ferguson 1969; Van Devender 1977; Van Devender and Spaulding 1979; Wells 1976). Eastern Nevada is represented by the analysis of middens from Smith Creek Canyon (Thompson 1979) and other sites (Thompson and Mead 1982). Thompson is currently analyzing pack rat middens from the James Creek Shelter in eastern Nevada and has com- pleted work on Gatecliff Shelter (Thompson and Hattori 1983).

Hattori and Thompson are also examining midden from Neotoma nests of the Winnemucca Lake Region of western Nevada. However, as Davis (1982:72) points out, there is a general lack of such data from the western Great Basin. More middens need to be identified and analyzed.

The analysis of faunal remains has been limited to large projects with big budgets. Large collections of late Pleistocene mammals were collected at Tule Springs in southern Nevada (Haynes 1967) and Rye Patch Reservoir on the Humboldt River (Firby 1979). Other Pleistocene fossil locales have been identified that, with further investigation, may lead to the discovery of Paleoindian sites.

Grayson (1982) examines current issues in understanding frequencies of Great Basin mammals during the past 15,000 years.

Recent reports on major faunal assemblages cover the paleontology of Hidden Cave (Grayson 1985; Mead 1985; Smith 1985) in central Nevada and the paleontology of Gatecliff Shelter (Grayson 1983; Thomas 1983c; Mead, Grayson, and Casteel 1983) in western Nevada. Dansie (1979a) and Dansie and Ringkob (1979) report on faunal assemblages from two sites in the Reno area. The faunal remains of four sites in Smith Creek Canyon in eastern Nevada have also been analyzed (Miller 1979). In the Humboldt River Basin, the Ezra's Retreat (Kobori 1979) and Rye Patch (Dansie 1979b) assemblages are important. Collections from Dryden Shelter in western Nevada and James Creek Rockshelter in eastern Nevada are currently being studied.

The dating of tephra and other volcanic deposits to establish base- lines for local and regional chronologies has been undertaken by Davis (1978) for the Lahontan Basin. Volcanic ash samples are currently collected and studied at the Desert Research Institute. Davis (1978)

established Mazama ash as an index marker for sites in northwestern Nevada, but other Holocene ash falls originating in the Inyo-Mono region need to be distinguished and dated. The identification of geomorphic sequences based on lacustrine deposits has been centered in the Lahontan Basin of western Nevada (Mifflin and Wheat 1979; Morrison 1964; Morrison and Frye 1965), yet Davis (1982) considers the complexities of the area such that only a tentative chronology of the late Quaternary environment is possible.

Tree ring chronologies have not been established, although the potential exists given the presence of pinyon pine and bristlecone pine in Nevada. Corings of pinyon trees from the Cortez Mining District in central Nevada were taken to study historic pinyon utilization (Hattori, Thompson, and McLane 1984).

Summaries and Syntheses

The BLM has stimulated the production of most of the regional archeological overviews of the State. The overviews vary greatly in quality, are for the most part a review of the existing data base, and are CRM-oriented. The overview for the Carson City District (Pendleton, McLane, and Thomas 1982) is an excellent reference for archeological research conducted in western Nevada and devotes one volume to tables summarizing data from each archeological site on the district. The section on historic themes and sites is equally strong. James (1981) provides an able overview of archeological research conducted in eastern Nevada. Central Nevada has been similarly treated (Smith et al. 1983; Bowers and Muessig 1982; Welch 1981). Copies of these publications are available at the BLM State Office and are invaluable references. Other overviews prepared through Federal agency involvement include Pippin and Zerga's overview of Yucca Mountain (1981) on the Nevada Test Site, Latschar and Greene's overview of historic resources in Death Valley (1981), Swarthout's overview of the Lower Colorado River Valley (1981), and Bard, Busby, and Findlay's literature review of the Carson and Humboldt Sinks (1981). Elston and Earl (1979) completed a cursory overview of the Sheldon Antelope Range and an historic sites inventory was recently completed by Fish and Wildlife Service staff (1985). The Hawthorne Army Depot has received similar treatment (Cleland et al. 1984).

A number of publications synthesize information on a particular basin or geographic region to test models of settlement patterns. One of the best known is Thomas' testing of Steward's (1938) model of subsistence-settlement. Thomas (1973) tested the ethnographic subsistence pattern of Reese River Valley in central Nevada against the archeological record of the prehistoric period. Most recently, Thomas (1983a) has pulled together data from the Monitor Valley area, including site data on the Toquima and Monitor Ranges that surround the valley, to develop a model to anticipate the archeology of this area in central Nevada. The long anticipated Gatecliff Shelter report (Thomas 1983b) provides a continuous record of human habitation in central Nevada and establishes a chronology for central Nevada sites.

Debate over the early habitation of the central Great Basin continues, however. Railroad Valley (McGonagle and Waski 1978) and Grass Valley

(Elston 1980) both have sites that appear to be pre-Archaic, but excavation and further investigation await funding.

Pine Valley has been intensively investigated (Hatoff 1974; Turner 1984) and the long anticipated report describing the results of excavation by the Nevada Department of Transportation has now been released. The volume also contains the results of a study of pollen samples taken from Pine Valley marshes (Thompson 1984).

The period of historic transition and change in settlement patterns in central Nevada has also been examined following a systematic inventory of Grass Valley by Wells (1983).

In western Nevada, Kelly et al. (1982) sampled the Carson Sink and Stillwater Range to determine the importance of marsh resources. The effect of lacustrine exploitation on prehistoric occupation of the western Great Basin remains poorly understood (Thomas 1985:21). However, the recent discovery of numerous burials and evidence of intense occupation at the Stillwater Marsh will lead to new interpretations of prehistory in the western Great Basin, shedding light on the exploitation of marshland resources and, possibly, the Numic expansion.

Prehistoric utilization of pinyon pine has been studied by Pippin at Borealis in western Nevada. Results of this major data recovery effort await publication.

Studies in northwest Nevada will also shed light on prehistoric settlement. Melinda Leach of the University of California-Los Angeles is completing her dissertation on the archeology of Massacre Lake, a transitional zone between California and Great Basin peoples. Although the High Rock Canyon-Sheldon Antelope Range area has been extensively surveyed and excavated, very little has been published; Thomas Layton of San Jose State University possesses a major collection from Last Supper Cave. Eugene Hattori (1982) completed work on sites at Falcon Hill in western Nevada and Don Manual of the Susanville District (BLM) is finishing a major report on the Pittsville site (in California) which may elucidate interregional transactions.

Clark (1984) recently completed work testing a model of settlement patterns with respect to the availability of irrigable land in Moapa Valley, southern Nevada. She recorded Basketmaker, Pueblo, and Paiute occupation sites and noted their variability in distribution.

Other completed studies in southern Nevada include Rafferty's (1984) examination of prehistoric settlement in Las Vegas Valley and Rafferty and Blair's (1984) work at Billy Goat Peak with special regard to the interface between Southern Paiute and Anasazi cultures.

Interest in models of subsistence-settlement patterns increased during the MX Missle Project, particularly in predicting the location of significant sites so the Air Force could avoid impacts to them. Busby and Kobori (1980) combined Steward's model with concepts of optimal foraging strategy in an attempt to understand the pattern of site locations in over twenty

valleys in central Nevada. Given contract restraints, the sample proved too small and the generalizations too gross to be useful. Refinement of the approach and testing of smaller geographic units is suggested.

Other MX consultants turned to Binford's (1980) foraging and collecting model for use in the central Great Basin (see Fowler et al. 1980). Five site types (residential bases, field camps, locations, stations, and rock art) were defined, and anticipated expressions in the archeological record were described (Holmer et al. 1980:29; Holmer and O'Connell 1983). With the demise of the MX project, this model of site distribution based on cultural-ecological theory was not tested in Nevada. Rusco and Kuffner (1981:11) proposes modifications in the model before it can be used effectively in Nevada.

However, Intermountain Research (Zeier and Stornetta 1984) tested the foraging and collecting model of settlement in central Nevada at the proposed site of a large mining project. The results were encouraging and provide positive feedback for the use of models. Zeier (1981) also ably constructed a model predicting the location of significant archeological sites in three valleys in eastern Nevada, which proved its worth in testing. The location of the power plant, the project for which the research was designed, was however determined by factors other than archeological sensitivity.

Landmark studies in historic archeology include investigations at Lovelock's Old Chinatown (Hattori et al. 1979) and Hardesty and Hattori's (1982) work at Cortez. Both studies draw interesting conclusions about ethnic populations. Transportation systems have been studied by Jones (1980) and Hardesty (1979). Other industrial sites such as railroad beds and salt and soda works have been investigated by Sharon Edaburn Taylor of the Churchill County Museum.

Chronologies for Nevada have been established, although problems remain. Most archeological sites are surficial phenomena and for rough dating of such sites, archeologists rely heavily on projectile point types. Obviously, time markers other than projectile points should be developed since many so-called diagnostics or time markers, such as the Humboldt type, have such long time spans as to be of limited usefulness. There is a need, too, for the establishment of a chronological framework based on data from stratified sites. Unfortunately, many open stratified sites in northern Nevada and rockshelter and cave sites in the rest of the state have been heavily vandalized so that the opportunities to assemble such data grow dimmer by the year.

Pre-Archaic sites and their distribution in Nevada continue to pose problems. The location of stratified Western Pluvial Lakes Tradition sites and a study of their pattern of occurrence in the Great Basin would answer questions regarding subsistence-settlement patterns of early human occupation in the Great Basin. The cultural history of southern Nevada remains a problem, although great strides have been taken in synthesizing current data to establish sequences and relationships (Rafferty 1984). Lastly, the chronology of southern Nevada still needs work because there is little consensus on dating the earlier projectile point types such as Pinto,

Gypsum, and Amargosa. These points have been used as the primary means of dating southern Nevada Archaic sites (Lyneis 1982:169).

Research Questions

Current research is spread throughout the State. Daniel Larson of the University of California-Santa Barbara is examining the role of small climatic fluctuations in the abandonment of agricultural subsistence in the Virgin River area of southern Nevada. Lonnie Pippin is also examining the role environmental change played in shifts in subsistence-settlement patterns at Yucca Mountain, on the Nevada Test Site.

Rob Bonnichsen from the University of Maine at Orono and William Clewlow of Ancient Enterprises in Santa Monica, California, are both looking for definite Paleoindian sites in Nevada. Clewlow is currently writing a monograph based on his survey work which included the identification of potential "early" sites in the Black Rock Desert of northwestern Nevada. Bonnichsen has been investigating approximately six Pleistocene fossil locales in search of Paleoindian remains.

David Thomas of the American Museum of Natural History is continuing the analysis of artifacts from Alta Toquima, a high altitude site in central Nevada. He is interested in the occurrence of other similar sites in central Nevada and their place in forager-collector models of subsistence-settlement. David Rhode from the University of Washington is comparing the distribution of sites in the Wassuk Mountains and Pine Grove Hills in western Nevada to determine the effects that availability of specific kinds of resources have on settlement.

The BLM also contributes in staff and dollars to the furthering of research interests, which ultimately aid in the management of the resources. The BLM is funding a synthesis of data and additional sampling of the Beowawe Geyser area in north central Nevada, a geothermal locality under development pressure. As well, the BLM is continuing the inventory of the Black Rock Desert. BLM archeologists on the Ely District have identified a number of Western Pluvial Lake Tradition (WPLT) sites in other than lacustrine environments. They are attempting to pull these data together for new interpretations of the WPLT in eastern Nevada.

In terms of future research in Nevada, many of the problems identified in the Nevada State Plan remain. Paleoenvironmental information is lacking in all areas of the State. Sources of data such as Neotoma nests, deposits of tephra, and pollen samples should be recorded and their sampling and analysis made part of any major excavation or data recovery plan in Nevada.

The excavation of stratified sites, particularly open sites, is critical to establishing good chronological frameworks in each region. The few good excavations reported upon must be stretched thin to cover large areas of the State. Stratified sites in northwestern Nevada could be excavated, if the funding were available.

A large-scale study of lithic scatters seems warranted since the majority of sites in the State are comprised of lithics and nothing else.

Determining the kinds of information these sites can relay to archeologists is crucial. Their characterization is necessary to test models of settlement patterns.

Historical archeological research is limited by a restricted data base. Sites are being recorded but not evaluated or compared to other sites. The evolution of mining technology and related industries, such as salt works, needs major work. The Zeier, Zerga, and Furnis (1985) study of Carbonari sites is a step forward.

The BLM sets priorities and goals each fiscal year to address critical needs in cultural resources. So, too, should all archeologists--research, contract, and management--decide on priorities each year and enlist whatever support is necessary in terms of professional and amateur volunteers and funds from various sources to accomplish some research goal. An example of such coordinated effort is the assembling of professional archeologists and members of the Nevada Archaeological Association a few weekends a year to perform surveys and record sites such as the large Pistone Site in western Nevada.

Regional Planning

Nevada is not currently involved in any cross-state research designs or plans. During the MX project, a regional research design was envisioned (Fowler et al. 1980; Holmer 1980), but a plan was never implemented. The potential exists to examine region-wide questions.

Eastern Nevada and western Utah share research interest in the Fremont culture: geographic boundaries, subsistence practices, and settlement patterns. Southern Nevada shares cultural history with the Southwest and southern California, making it a cultural frontier according to Rafferty (1984). The study of Virgin Branch Anasazi settlement in southern Nevada is not possible without considering Anasazi expansion and contraction in the Southwest. Likewise, management goals can be regional to avoid duplication of efforts across state boundaries and to give adequate consideration to large-scale research questions.

Since the current State Plan is flexible, it would be easy to integrate regional research designs. The SHPO serves as the clearinghouse for all major projects; large-scale archeological investigations would be required to address regional as well as state goals. Federal agencies would need copies of such a regional plan to supplement the State Plan. As the State Plan is rewritten, aspects of the regional plan can be incorporated.

A number of federal and state agencies have existing land use plans, although few regard cultural resources as an issue. National Park Service (NPS) has made cultural resource management a major component of plans for Lake Mead Recreational Area and Death Valley National Monument (National Park Service 1982; 1985). NPS needs to be provided a copy of the State plan as well as any regional plan. Other land managing agencies, such as the BLM and U.S. Forest Service, employ archeologists that would likely use the plans to supplement or support recommendations within their cultural

resource overviews. Many of these same people helped develop the State Plan and would likely endorse a regional document, especially if it had the backing of the professional organizations and academia.

There is little certainty that predictive models on a regional basis would be well received or used. Management archeologists would likely want to help develop predictive models and most would prefer to see models developed for small geographic areas, such as a basin, rather than large-scale regional designs. The SHPO's experience with models has been mixed.

The SHPO has funded two projects involving the development of models for management purposes. The first effort, directed by Hardesty and Firby (1980), identified zones of archeological expectations based on documentary evidence of the well-known historic Comstock district. In 1981, the model was tested primarily to determine whether the zones were distinguishable in the archeological record, and the zones were ranked in terms of the extent to which significant sites, both historic and prehistoric, could be expected. As a result of this work (Hardesty et al. 1982), the number of zones was reduced from 29 to a more manageable six and expectations of site types, numbers of site types, and site significance were developed for the Virginia City National Landmark District. A sample survey was conducted to determine whether the model was accurate; results were encouraging and sensitivity maps were made for use by planners. Unfortunately, this work has not been widely disseminated. The Comstock Historic District Commission is aware of its existence but has not put it to its intended use as a planning tool.

A second project recently completed, aimed to explore the use of remote sensing data (LANDSAT) is the locational modeling of prehistoric archeological sites. The archeologists (Lichty, Elston, and O'Connell 1984) based the study on the Gund and Saval Ranches where a number of surveys have been conducted. By using remote sensing data as a means of identifying environmental variables, they believed, a more precise sampling could be achieved and results from relatively small study areas could be projected over much larger regions, thus reducing the expense of on-ground survey efforts. The model was successful in delineating environmental zones and site densities, but has its limits when extended into larger areas incorporating environmental variables other than those originally identified. Researchers are warned that the prediction of site frequencies is not a means of isolating sites by specific time periods or by functional types, so there is limited application in archeological research. Additionally, sites were discovered in almost every zone, making it difficult to eliminate the need for surveys--a conclusion to make planners grimace. If an explanatory model is developed to deal with why particular kinds of sites are in particular zones, the site frequency model might be more useful to planners.

Communication with Native Americans

Native American groups have not routinely been notified of archeological work. Implementation of the Archeological Resource Protection Act (ARPA) regulations and new Section 106 regulations will change this situation and notification of one or a number of the 25 intertribal councils prior to project commencement will become the rule.

A number of Indian reservations exist in the State. Because the expenditure of federal funds on these lands is common, through Department of Housing and Urban Development or Economic Development Agency loans, the tribal planners often contact the SHPO regarding the necessity of archeological surveys. Given the frequency of this occurrence, the Washoe Tribe contracted with Intermountain Research (IMR) to prepare a cultural resources management plan for their lands in western Nevada. The plan (IMR 1985) is an outstanding example of the manner in which such coordination should take place.

Formal Native American consultation is requested for projects that involve large tracts of land, such as transmission lines, land withdrawals, and Department of Defense projects such as the MX Missle effort. Information regarding sacred sites, plant gathering and hunting areas, and burials and other areas of concern, is taken into consideration during project planning. A successful example of cooperative consultation was prepared by Stoffle and Dobyns (1983) for the Intermountain Power Project.

Native Americans must also be notified in the event burials are encountered during archeological survey or excavation. A Memorandum of Understanding describes procedures for contacting the SHPO, Indian Commission, and the appropriate intertribal council. The MOU does not specify how burials should be treated, although the advice of Native Americans is to be considered. Since the implementation of the document, Native Americans have requested reburials of human remains on reservation grounds, but have agreed to the scientific study of burials prior to reinterment.

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Fig. 1. The Mojave Desert Subregion.

Fig. 1. The Mojave Desert Subregion.

MOJAVE DESERT, CALIFORNIA

by

Margaret M. Lyneis and Michael E. Macko

The Subregion

The California portion of the Mojave Desert (Fig. 1), for our present purposes, coincides with the Mojave Desert Province as defined by Barbour (1977) with one exception. From Walker Pass north, we follow the western boundary of the California Desert Conservation Area as defined by the California Desert Planning Staff of the Bureau of Land Management. This boundary approximates longitude 118 degrees east, but omits all of Owens Valley by detouring around the south margin of Owens Lake before resuming its northward direction. The western boundary is sharply marked toward the south by the Garlock and San Andreas faults. The southern boundary is marked by the Little San Bernardino, Cottonwood and Eagle Mountains, but from there to the Colorado River it must be considered arbitrary for there is no strong topographic limitation, and vegetation of the Mojave and Colorado Deserts blends. The Riverside-San Bernardino County line is a convenient approximation (Barbour 1977:836).

The Mojave Desert is almost bisected by the eastward course of the Mojave River, but does not require division into subregions either culturally or environmentally to structure or consideration. Creosote bush scrub vegetation dominates the area, complemented by saltbush scrub, and at higher elevations, blackbush scrub and Joshua tree woodland. Juniper or pinyon-juniper woodlands are restricted and many ranges of the Mojave Desert are clothed only in scrub vegetation.

The Mojave Desert has an established record of occupation spanning the past 12,000 years. Earlier dates have been suggested for particular localities, including the Calico site (Simpson 1977, 1980; Simpson et al. 1981), Lake Manix (Simpson 1958, 1964), and China Lake (Davis and Panlaqui 1978). Basally fluted points have been found in surface assemblages as documented by Davis and Panlaqui (1978).

The post-Pleistocene sequence is usually considered in five time periods (Lyneis 1982; Warren 1984a). Sites of the Lake Mojave (10,000-5000 B.C.) and Pinto periods (5000-2000 B.C.) are concentrated along relict watercourses and shorelines, and seem to represent a rather selective use of the desert's landscape by people of a hunting-foraging economy. The Elko or Gypsum period sees a developing dependence on food-grinding technology, but site distribution patterns remain unclear. The Saratoga Springs period (A.D. 500-1200) marks the activation of torquoise mining in the Halloran Springs area, and Southwestern influences are seen in the addition of ceramics to the domestic inventory. Horticulture is practiced on the eastern margin of the region, and during this period or the subsequent Protohistoric, small gardens at favored spots may have added to the economy of other desert localities in a minor way. During the Protohistoric period (A.D. 1200-historic) the archaeological record can be

identified with the antecedents of the historically known South Paiute and Mojave; Anasazi occupance and influences have been terminated.

The Mojave Desert has a high proportion of federally owned land, and a distinctive mix of agencies is responsible for cultural resource management there. The Bureau of Land Management controls vast stretches of the area. The Mojave also includes Death Valley National Monument, China Lake Naval Weapons Center, Edwards Air Force Base, the U.S. Army's National Training Center at Fort Irwin, and the Marine Corps base at Twentynine Palms. Each of these encompasses a large area. These agencies are at different stages in developing cultural resource management programs, ranging from the base at Twentynine Palms which has made no provision for considering its cultural resources, to Fort Irwin, which has been the subject of a program of survey, testing and data recovery for more than 5 years. The California Mojave Desert also includes about three-fourths of the area subjected to inventory in the preparation of the California Desert Conservation Area Plan. That effort remains one of the most extensive inventories undertaken for regional planning. Its planning and execution spanned more than six years, and since its completion in 1980 it provides some experience in implementation as well as in design and execution of inventory-for-planning purposes.

State Plans

In California, the State Office of Historic Preservation (SHPO) is sponsoring two experiments with cultural resource protection plans; the state planners hope the results will suggest how the State Plan should look. Pilot studies for resource protection plans are being developed for the Northwest Coast and Santa Barbara Coastal region. Elements of RP3-like plans (Resource Planning Protection Process; see USDI 1980a) developed for the Mojave desert include the Historic Preservation Plan for Fort Irwin, the Cultural Resource Protection Plan being developed for Death Valley National Monument, the Overview and Inventory Plan prepared for China Lake Naval Weapons Center, and the Class I and II surveys in the California Desert Conservation Area. Some protection is afforded resources on State and County land by way of the California Environmental Quality Act, but little can be done for private land. The California SHPO does not require survey of private land regardless of the undertaking if no federal permitting process is involved; responsibility is generally passed to county officials, and each county varies in the treatment of cultural resources.

The current status of resource protection planning in the Mojave Desert can be likened to the proposal process in contract archaeology: ask four archaeologists to each prepare a research design for excavating a site; four very different designs invariably result. The designs will vary in sampling approach, research orientation, expectations, and significance evaluation criteria. Because of the variety of agencies with responsibility in the area, a variety of approaches are in effect.

In the case of Death Valley National Monument, the National Park Service chose the Monument as an area for an RP3 pilot study. NPS planners and managers are preparing the final document, without input from

professional archaeologists having the necessary knowledge of the resource base to make an informed plan.

No other area of the Mojave Desert is seeing the development of RP3-like plans per se. Rather, agency managers are content with backdrops to decision-making based on data from overviews, sample surveys, and case-by-case eligibility determinations conducted by test excavation programs. Most agency managers feel these sources adequately define historic contexts by which particular resources may be evaluated, though others find historic contexts defined in overviews to be too general to be helpful in site-by-site evaluations.

Thus, contexts are brought into consideration and defined on a case-by-case basis. In this process historic contexts defined from National Register of Historic Places (NRHP) eligibility determination procedures may show little resemblance to the general overviews, and often indicate simply that the overviews are dated. But because the current Section 106 process provides for proper identification of resources, including an adequate period of review and consultation so that a proper evaluation can be made, generally there has been adequate consideration of historic contexts by way of research design preparation. The Section 106 process has provided an inlet for innovation and new techniques for use in the identification, registration, and evaluation process.

Painfully lacking in the Mojave Desert is a mechanism for regional establishment of criteria for acceptance of historic contexts; similarly, there is a need for the building of bridges between contexts and the configuration of sites in the field. Standardization or justification of data recovery and analysis techniques appropriate for addressing contexts defined for a region are undeveloped, the result of management by numerous agencies.

Nevertheless, in many regards the Section 106 process has been successfully applied to the identification, registration, evaluation, and avoidance of cultural resources in the Mojave Desert. In spite of the inconsistencies resulting from its application by different agencies or different individuals within the same agency, the Section 106 review process is the strongest resource protection planning process available. Agencies having overviews and good sample survey data are not likely to opt for a new process when the current process is working to meet their defined priorities and contexts, whether on a case-by-case basis or within a small region of the desert. We must be concerned, however, with the potential erosion of current protective registration afforded by the Section 106 process when RP3 efforts produce scanty, undefensible products as may be the case where plans are created without the involvement of professional archaeologists. We may be better off in the Mojave Desert with the Section 106 process than with other possible alternatives, even at the risk of continuing with the disjunct agency-by-agency approaches to identification, registration, and evaluation of sites.

Existing Records

Location

The records for cultural resources throughout most of the Mojave Desert have been transferred recently to the Archaeological Research Unit, University of California, Riverside. This set of records is well-travelled. Curated initially at the University of California, Berkeley, the records, maps, and other items were then transferred to the University of California, Los Angeles. Later, the files were transferred to the San Bernardino County Museum, where they remained until the most recent move in January, 1985. In the last five years the records have been consolidated, synthesized, verified and in some instances corrected to accurately illustrate and document the resources.

Many other institutions have conducted research in the Mojave Desert and as many repositories of information have developed. The University of Nevada at Las Vegas; the Universities of California at Los Angeles, Berkeley, and Riverside; the Southwest Museum; the Southwest Museum extension at Twentynine Palms; the San Diego Museum of Man; the California State College Consortium; the Archaeological Survey Association of Southern California; the Mojave River Valley Museum; and others have conducted archaeological research and have developed many of their own records and collections.

Content

The content of the site record files at various institutions is fairly standard with respect to how site records are filed and keyed onto master U.S.G.S. quad sheets for geographic reference. The diversity in forms utilized to record sites is not as broad as can be found in other parts of the country. The 5,364 site records on file as of 1985 for San Bernardino County include at least five different site record forms. The majority of sites are recorded on University of California site survey forms or the BLM's cultural resources inventory record forms. Each of these forms reflect one of two very different recording procedures. The first involves verbal descriptions which are primarily impressions of individuals making the site record. Such forms include the California State site survey form, the San Bernardino County Museum site record form, and various forms used by the University of California. The other class of forms includes those designed to record systematically a shotgun blast of site attributes rather than the impressions of the field investigator. The BLM Riverside District archaeological site form and the form used in the California Desert Survey Project are examples of forms which provide more consistent recording of site attributes across a large region.

The forms used in recording historic archaeological sites in California are the same as those used in recording prehistoric sites; one simply adds an "H" suffix to the site's trinomial designation. The BLM has developed distinct forms to record historic archaeological sites. These are similar to the prehistoric site record forms in that attributes of each site are checked systematically for all historic sites recorded.

The integration of the many thousands of site records into a single data bank is being explored on a preliminary and elementary level by the SHPO. The remedial level of this procedure derives from the mixed nature of the site records themselves. In essence, the California SHPO selected the least common denominators on previous site records when it prepared the new (1982) site record form. The new form is virtually identical in content to previous forms but it has grown in size: formerly a site record involved two to four pages. Now, the same information is recorded onto six or more pages. This approach in California contrasts sharply with the development of the IMACS (Intermountain Antiquities Computer System; see Lichty, this volume) recording and encoding procedure used in the most of the Great Basin states, except California (and Oregon). As mentioned above, however, the BLM Riverside District archaeological site form and the form used in the Desert Survey Project are particularly amenable to encoding and storage into a single data base. Such was achieved by Coombs (1979a, 1979b, 1979c, 1979d) to a limited extent, with the site data generated from sample surveys eight years ago. Site record forms and procedures have not been refined as a result of the Desert Plan final results.

Organization/Access

While housed at the San Bernardino County Museum, site records and documents achieved a good state of organization at the hands of Michael Lerch and Gerald Smith. The organization they imposed on the records and other files is expected to be maintained or improved at their new home in Riverside.

The organization and accessibility of records, collections, and documents other than the California Site Survey files vary considerably. They span a continuum from easily accessible site record files to the often confused and difficult-of-access collections of private collectors or avocationalists. The current scattering of the Campbell's collections and documentation from their Silver Lake and Pinto Basin investigations is an example of the problems generated by splitting up notes and collections. The collections are split between the Southwest Museum in Los Angeles, where the bulk of the notes on their collections are also curated, and the Joshua Tree National Monument Museum facility in Twentynine Palms, where many of the specimens are packed tightly in a quonset hut. This separation creates considerable difficulty in logistics when one wishes to review collections and documents pertaining to them without arranging complicated loans.

Currently Operating CRM Collections Repositories in the Mojave Desert and Repositories of Major Great Basin Collections Outside the Great Basin

There are numerous institutions which maintain collections from the Mojave Desert, in addition to the garages of numerous avocational collectors. As noted above with reference to the Campbell's collections from the Lake Mojave and Pinto Basin sites, organizational and accessibility concerns make the existing situation difficult to work with. There is a clear need for data synthesis and reduction with regard to existing collections and those to be obtained in the future.

A list of repositories which have policies for accepting CRM collections would be limited to a handful of institutions. Although many facilities have CRM-generated collections, most of these curate only those collected by themselves or by affiliates. For example, the University of California, Riverside curates only those collections it generates, whether under the guise of CRM or other research. Therefore, it is probably appropriate to list those facilities and institutions with any collections from the Mojave Desert. The following is inevitably a partial listing, though all major repositories are included.

Facility	Archaeological Laboratory
Location	2572 A Port Street West Sacramento, California
Affiliation	California Department of Parks and Recreation
Accepts CRM/Fee?	Yes, St. Parks only
Policy	Yes
Contact	Christina Swiden (916) 445-9663

Facility	State Indian Museum
Location	111 I Street Sacramento, California 95814
Affiliation	California Department of Parks and Recreation, Sacramento District
Accepts CRM/Fee?	?
Policy	Yes
Contact	Michael Tucker (916) 323-1046

Facility	Nevada State Museum
Location	600 N. Carson Street; Carson City, Nevada 89510 700 Twin Lakes Drive; Las Vegas, Nevada 89107
Affiliation	State of Nevada
Accepts CRM/Fee?	Yes/$1080/cubic foot (somewhat negotiable)
Policy	Yes
Contact	Donald Tuohy (702) 885-4810 Jeanne Clark (702) 385-0115

Facility	Armacost Library
Location	Redlands, California 92374
Affiliation	University of Redlands/Archaeological Survey, Association of Southern California
Accepts CRM/Fee?	?
Policy	Yes
Contact	Ruth D. Simpson (714) 792-1334 Roger Baty (714) 793-2121, ext. 217

Facility	Museum of Anthropology
Location	800 North State College Blvd. Fullerton, California 92634
Affiliation	California State University
Accepts CRM/Fee?	Yes/$50/cubic foot
Policy	Yes
Contact	Constance Cameron (714) 773-3977

Facility	Roy Tate Museum
Location	Victorville
Affiliation	Private
Accepts CRM/Fee?	No
Policy	No
Comments	Extensive private collection of historic tools.
Contact	Mr. Roy Tate (619) 244-2745

Facility	Death Valley Museum
Location	Death Valley, California 92328
Affiliation	Death Valley National Monument
Accepts CRM/Fee?	No
Policy	N.P.S.
Contact	Shirley Harding (619) 786-2331

Facility	Maturango Museum
Location	P. O. Box 1776 Ridgecrest, California 93555
Affiliation	China Lake Naval Weapons Center
Accepts CRM/Fee?	Yes (if germane to Northern Mojave History/Prehistory)
Policy	No
Contact	Carol Panlaqui, Curator (619) 446-6900

Facility	Victor Valley Museum
Location	14455 Civic Drive Victorville, California
Affiliation	San Bernardino County
Accepts CRM/Fee?	Possible
Policy	Yes
Contact	Roy Tate, Curator (619) 245-1624

Facility	Antelope Valley Indian Museum
Location	15701 East Avenue M Lancaster, California
Affiliation	California Department of Parks and Recreation
Accepts CRM/Fees?	Yes
Policy	Yes
Contact	Jack Atkinson (805) 946-1335

Facility	Joshua Tree National Monument
Location	74485 National Monument Drive Twentynine Palms, California 92277
Affiliation	National Park Service
Accepts CRM/Fee?	Monument only
Policy	Yes
Contact	Superintendent (619) 367-7511

Facility	Mojave River Valley Museum
Location	270 E. Virginia Way Barstow, California 92311
Affiliation	Private
Accepts CRM/Fee?	No
Policy	No
Contact	Bill Peterson, President (619) 256-5452

Facility	San Bernardino County Museum
Location	Redlands, California
Affiliation	San Bernardino County
Accepts CRM/Fee?	No
Policy	Yes
Contact	Ruth D. Simpson (714) 792-1334

Facility	San Bernardino County Museum Association
Location	Redlands, California
Affiliation	Private
Accepts CRM/Fee?	Yes, negotiable
Policy	Yes
Contact	Dr. Gerald Smith

Facility	Archaeological Survey
Location	405 Hilgard, Los Angeles, California
Affiliation	University of California
Accepts CRM/Fee?	Yes
Policy	Yes
Contact	Richard Aycock, Susan Colby (213) 825-1720

Facility	Archaeological Research Unit
Location	Riverside, California
Affiliation	University of California
Accepts CRM/Fee?	University originated only
Policy	Yes
Contact	Dr. Phil Wilke (714) 787-3885

Facility	Southwest Museum
Location	234 Museum Dr., P.O. Box 128 Los Angeles, California 90042
Affiliation	Private
Accepts CRM/Fee?	No
Policy	Yes
Contact	George Kritzman, Peter Welsh (213) 221-2164

Facility	Desert Museum
Location	P. O. Box 2288 Palm Springs, California 92263
Affiliation	Private
Accepts CRM/Fee?	Possible
Policy	Yes
Contact	Jim Cornett (619) 325-7186

Facility	Lowie Museum of Anthropology
Location	Berkeley, California
Affiliation	University of California
Accepts CRM/Fee?	Yes/$700/cubic foot
Policy	Yes
Contact	Frank Norick (415) 642-3681

Facility	Archaeological Resource Facility
Location	Tiburon, California
Affiliation	San Francisco State University
Accepts CRM/Fee?	?
Policy	Yes
Contact	Gary Pahl (415) 469-1435

Facility	Western Archaeological and Conservation Center
Location	1415 North 6th Avenue Tucson, Arizona 85717
Affiliation	National Park Service
Accepts CRM/Fee?	NPS projects only
Policy	Yes
Contact	Gloria Renner, George Teague (602) 762-6476

Facility	Museum of Northern Arizona
Location	Route 4, P.O. Box 720 Flagstaff, Arizona 86001
Affiliation	Private
Accepts CRM/Fee?	Case by case, negotiable
Policy	Yes (not with regard to CRM)
Contact	Bob Crody, Donald E. Weaver, Jr. (602) 774-5211

Facility	Museum of Natural History, Environmental Research Center
Location	4505 Maryland Parkway Las Vegas, Nevada 89154
Affiliation	University of Nevada
Accepts CRM/Fee?	Yes/$1380/cubic foot
Policy	Yes
Contact	Dr. Donald Baepler (702) 739-3743

Facility	San Diego Museum of Man
Location	Balboa Park, 1350 El Prado San Diego, California
Affiliation	Private
Accepts CRM/Fee?	No
Policy	Yes
Contact	Ken Hedges, Grace Johnson (619) 239-2001

Other Photographic/Archival Records and Collections

The compilation of an index of photographic/archival records for the Mojave Desert would be an inordinately time consuming and difficult task. The BLM overviews mentioned above used some primary sources of historic information and contain lists of repositories for collections and archives. These lists are not exhaustive. It is improbable that a single compilation of existing photographic/archival records could be developed due to the likelihood that hundreds of individuals may have some documentation pertaining to the history or prehistory of the Mojave Desert. This is true particularly of the descendants of individuals resident in the desert during the 19th Century. Those active in avocational collecting probably represent a staggering number.

Survey Data: Nature of Coverage and Gaps in Coverage

The Mojave Desert has been the subject of extremely large areal surveys for cultural resource studies as well as individual research efforts. Survey coverage stemming from CRM in the Mojave Desert can be classed into one of four categories: linear surveys for utility corridors, large block surveys for military reservations, BLM Class II desert plan sample surveys, and small development projects on nonfederally owned land. In all instances but the Class II sample surveys, the survey coverage is generally limited to project impact areas. With respect to sampling the linear surveys for utility companies and the block surveys of military reservations can be considered to complement each other--utility corridors provide cross sections of the Mojave Desert, while block surveys provide concentrated coverage of large areas.

Until the Mojave Desert is surveyed 100% there will of course be gaps in survey coverage. The extensive nature of survey coverage in the Mojave Desert, however, has produced an adequate cross-section of environmental and cultural areas. The utility corridors primarily follow designated rights-of-way which parallel the Mojave River drainage and more or less bisect the Mojave Desert on a northeast-southwest axis. Utility corridors also follow north-south orientations along the western margin of the Mojave Desert. The large areas covered under military reservations provide block samples, primarily within the western Mojave Desert. These sample blocks include the China Lake Naval Weapons Center, Fort Irwin, George Air Force Base, and Edwards Air Force Base. A major gap in survey coverage in the Mojave Desert is in the south central Mojave Desert in the vicinity of the Twentynine Palms Marine Corps Base.

The intensive survey coverage done on non-federal land is concentrated primarily in the vicinities of major urban centers, such as the Barstow and Victorville areas; the coverage beyond these areas is very spotty and most commonly involves small mining projects.

Lessons Learned from Sampling Surveys

Sampling surveys are usually undertaken by agencies to develop predictions about site types and patterns of location. Three major studies examining site locations relative to environmental characteristics have come from the California portion of the Mojave Desert: the BLM's California Desert Conservation Area Inventory (CDCAI), the Fort Irwin Archaeological Project (FIAP), and part of the Naval Weapons Center, China Lake.

The CDCAI is one of the most extensive surveys undertaken in the form of a related series of probability samples. By June 1980, some 2,569 sites had been recorded (Lyneis *et al*. 1980). The efficacy of the CDCAI in the preparation of the California Desert Conservation Area Plan has yet to be evaluated. Ritter and Coombs (1981) have, however, drawn together some of its implications for settlement-subsistence studies.

As a probability sample, the CDCAI was flawed. The inventory was conducted through a series of contracts to a number of firms. The

percentages of area examined varied among the contracts, but were in all cases low, ranging from 0.5% of the area in the Central Mojave and Colorado Desert (Gallegos et al. 1980:1) to 1.0% in the Owlshead/Amarosa-Mojave Basin Planning Units (Brooks et al. (1981:iv). Although transect shapes, and inventory forms recording site types, impacts, and environmental characteristics were standard throughout the surveys, each contracted survey represents an individual sample. Contractors were permitted to allocate their samples quite differently, stratifying according to variables of their own choice and devoting some of the survey to judgmentally placed transects. Resulting data were not treated consistently in developing generalizations or projections. The number of sites recorded within each inventory area was small, insufficient to say much about the area sampled, and the differences between the methods used in different inventory areas inhibited the search for desert-wide generalizations. In an initial effort to analyze the CDCAI data desertwide, Coombs (1979c:3) said "a huge sample (the archaeologists' dream) has been divided and redivided into an analytic nightmare--a series of comparatively small samples that cannot be easily compared or combined."

Despite the difficulties of the CDCAI, Lyneis (1984:C-6) found suggestions of patterns that might have predictive value for Fort Irwin, particularly in Coombs (1979a,b,d) and Gallegos et al. (1980). It was thought that the utility of these patterns as bases for projecting site densities might be tested by FIAP. This was not to be, however, for inventory at Fort Irwin has been devoted almost entirely to imminently endangered, and usually, already impacted areas of the Fort, and has been conducted almost entirely on a judgmental basis. So far, the survey does not constitute a probability sample of either the Fort as a whole or of any subregion within it.

As a substantial data base for judgmental generalization, the 412 FIAP sites are limited in their value. Projections of site densities are usually based on apparent correlations of site types with environmental characteristics. Three-fourths of the site inventory was accumulated prior to 1983, when environmental characteristics were recorded only at and in the immediate vicinity of sites, not independently of site locations. Site distributions can be examined relative to environmental variables only for variables that can be retroactively discerned on maps or aerial photographs. Thus the Fort Irwin survey, while suited to the survey-salvage nature of the project (Lyneis, Warren and Cleland 1984), provides limited data for predicting patterns of site location. FIAP has accomplished 100% survey of relatively extensive portions of the Fort, however, providing data well-suited to the study of portions of settlement-subsistence systems (Underwood 1982, 1983; Robarchek et al. 1984). Site survey data of consistent quality for extensive areas are rare in the Mojave Desert, and FIAP should provide important new insights into contrasting patterns of site locations for different periods.

A promising pilot study has been undertaken on selected portions of the Naval Weapons Center, China Lake, in the northern part of the Mojave Desert (Elston et al. 1983). Using both transect survey data and environmental classification mapped from LANDSAT tapes, Intermountain Research projected sensitivity maps for the North and Mojave B ranges. Taking the

investigation further, the investigators then looked separately at the distribution of site classes judged as potentially eligible for the National Register. By projecting both integrity and significance scores for a variety of site types, they produced two maps that give very different impressions of the Naval Weapons Center. Sites likely to be eligible for the National Register are not predicted to be distributed over the landscape in the same fashion as are all sites.

The low site density characteristic of the California Desert makes predictive modeling based on probability sampling of questionable economy. The problem is compounded by the fact that types of sites with low information yields such as lithic scatters and isolated finds make up 40 to 60% of the sites encountered (Lyneis 1984). Were we to come into the habit of calculating the confidence intervals that Berry (1984) so rightly tells us we should, we would like our data even less. As a research endeavor, predictive modeling developed as propositions based on theoretical models and tested with appropriate survey and testing strategies would advance our understanding of Mojave Desert prehistory and the nature of changing hunter-gatherer adaptations substantially. But the achievement of reliable projections of site densities based on quantitative analysis of site location data and distributions of environmental characteristics remains for the future.

Data quality requirements for long-term or large-scale regional planning are different from, and probably lesser than, those appropriate in cases where specific, direct, imminent impacts are expected. Projections of site densities based on properly executed probability sampling, with low (but calculated) confidence intervals may well have a role in CRM for land managing agencies. An understanding of the limited reliability of these projections should go a long way toward prevention of their potential misuses in management, misuses such as "clearing" areas that are in fact unsurveyed, for instance.

Environmental Data

Spatial Data

Environmental data recorded since the late nineteenth century are found at numerous government agencies and private companies which have been involved in meteorology, geology, and wildlife resource concerns. Environmental parameters have been given spotty coverage or neglected in cultural resource management studies in the past. It is ironic that not one CRM study in the Mojave Desert has provided a primary source of historic environmental data. Good environmental data for the Mojave Desert have come from individual research efforts, not CRM programs. Important sources include the lake sediment studies in the Cronies Basin conducted by Drover (1979), the environmental studies of Mehringer (1977), and the environmental data derived from the studies of Ore and Warren (1971). A potential gold mine of environmental data, particularly pertaining to the Late Pleistocene, could be derived from the large numbers of sediment cores excavated by drilling companies and mining companies in the area of extinct Pleistocene lake beds. Such samples are obtained regularly but are not being analyzed by archaeologists.

The lack of attention given modern environmental data in Mojave Desert CRM studies may reflect a more general neglect of the region. With respect to soils, for instance, the Soil Conservation Service has placed the desert area of California in its lowest priority category. No synthesis of soils data for the Mojave is planned until 1995. Some soils studies have been done as part of environmental assessments (e.g., Westinghouse 1976), but these are project-specific only.

Clearly, the most comprehensive, yet general, compilation of environmental data is that contained in the California Desert Conservation Area Plan (U.S. Department of the Interior 1980b). This document synthesizes a tremendous amount of data on geology, vegetation, and wildlife. The technical studies conducted for the plan include detailed information on springs, other water sources, and rare, threatened, and endangered plants and animals. The CDCA plan contains numerous mosaics of environmental resources albeit at a very small scale. Baseline study maps are at larger scales (e.g., 15' U.S.G.S.) and are available for inspection at the CDCA Riverside office.

In 1984, the U.S. Geological Survey revised the map coverage for much of the Mojave Desert. This effort, continuing into 1985, is resulting in the first-time production of 7.5' map coverage for areas formerly covered by 15' maps. The new maps include overlays of the complete UTM grid across entire quads.

Aerial photographic coverage is quite good for recent years and photos may be obtained for many areas from the BLM, Riverside. Private companies doing aerial surveys and photogrammetic map production, such as Great Basin Aerial Surveys, Sparks, Nevada, have good recent coverage of most utility corridors. Historic aerial photographs for the Mojave Desert are few. Some coverage is represented in the Spence-Fairchild aerial photograph collection, a large series of photos with low altitude flight dates as early as 1927. This collection is split between several institutions and one private company. Most the collection is maintained by the Universities of California at Santa Barbara and Los Angeles and by Whittier College, Whittier, California. Part is at Teledyne Geotronics in Long Beach, California.

Paleoenvironmental Data

Archaeological projects in cultural resource management have been responsible for considerable development in the paleoenvironmental data base for the Mojave Desert. Paleoenvironmental data, primarily packrat midden studies, have been accumulated for virtually all large survey studies that have been conducted in the Mojave Desert, most notably for the Intermountain Power Project (Spaulding 1984). The Intermountain Power Project (Macko et al. 1983) is currently initiating a detailed geomorphic study in the vicinity of Coyote Lake, the modern remnant of northern Lake Manix. This project will thoroughly analyze sediments, pollen, and ages of lake bed stratigraphy from four 200-foot cores and may yield important geomorphic data on Pleistocene-Holocene fluctuations of lakes in the Manix Basin.

The primary sources for regional paleoenvironmental data are mostly from areas peripheral to the Mojave (Adam 1967; Birman 1964; Curry 1968, 1969, 1971; La Marche 1973, 1974, 1978; La March and Mooney 1967; La Marche et al. 1974). New innovative studies of Mojave Desert paleoenvironments are forthcoming in the work of Ronald E. Dorn, of the University of California, Los Angeles.

Summaries and Syntheses

Two recent syntheses focus on the Mojave Desert. Warren (1974a) deals extensively with the Mojave Desert and the Colorado Desert which adjoins it to the south. Lyneis (1982) treats both the Nevada and California portions of the Mojave Desert. In addition, Wallace (1978) discusses it, along with other regions, in the California volume of the Handbook of North American Indians, and Warren and Crabtree (1972) have summarized it for the forthcoming Great Basin volume. A rather redundant series of syntheses resulted from overviews commissioned by the BLM in the course of the California Desert Inventory. Of those, Hall and Barker (1981), King and Casebier (1981), Norwood, Bull and Quinn (1980), Stickel and Weiman-Roberts (1980) and Warren, Knack and Warren (1980) summarized portions of the Mojave Desert. The overview for Edwards Air Force Base (Greenwood and McIntyre 1980) also includes regional syntheses of prehistory and history.

Each of these contains chronologies which vary in detail one from another. At one level, there appear to be only minor differences among them, expectable differences regarding naming and dating of periods. At another level, it is evident that chronology-building remains a major concern. The paucity of buried, stratified archaeological deposits has led to innovative searches for dating techniques suited to the region. The most recent and promising technique is cation-ratio dating of rock varnish (Whitley and Dorn 1984; Dorn et al. in press). Beginning and ending dates for the early to mid-Holocene Lake Mojave and Pinto periods are based on very few radiometric determinations, while obsidian hydration measurements, although widely applied, produce arguable "dates." The middle period of the chronology is variously termed Elko (Lyneis 1982) or Gypsum (Warren 1984a) and remains poorly dated and understood. After about A.D. 500, the region was an interface between peoples of the Colorado Desert to the south and Paiutes to the north, to judge from pottery (as archaeologists seem to do in this area), with perhaps an Anasazi intrusion as well (see especially Warren 1984a:Figure 8.25). Ceramic temporal and spatial variability is poorly understood. Periodization, in terms of naming and dating, is inconsistent, but Warren's (1984a) choice of terminology in naming Saratoga Springs (A.D. 500-1200) and Protohistoric (A.D. 1200-contact) periods has a satisfying neutrality about it.

Explicit models for Mojave Desert prehistory, whether synchronic settlement pattern models or diachronic, processual models, are almost non-existent. Ideas that structure research are usually generalizations based on inferences from the data base and largely implicit expectations derived from individual researchers' a priori interpretations of the prehistoric record. Despite the rarity of independently generated, testable models, research designs for the region show consistency in seeking

data regarding settlement patterns and environmental change. Technology, and often trade and exchange, are additional concerns.

The Fort Irwin research design (Warren 1984b) is the most ambitious formal guidance produced for research or cultural resource management in the Mojave Desert. It posits a subsistence focus model as the core of cultural adaptation of hunter-gatherers and projects a prehistoric record for the Holocene based on the interactions of subsistence foci, environmental change and population growth and decline. Among its predictions are technological shifts and settlement pattern changes within and between periods.

For China Lake, Elston et al. (1983) use E. L. Davis's (1975, 1978a, 1978b, 1982) interpretation of Pre-Archaic lifeways as a model, seeking to test the predicted distribution of pre-Archaic sites against China Lake survey data. That project also used a model of Archaic culture change developed by Elston (1982) as the premise on which to generate a number of propositions for field expectations regarding survey data.

Gary Coombs undertook to synthesize the site survey data that resulted from the California Desert Archaeological Inventory (CDAI). He was able to suggest two models regarding sites in the vicinity of springs. He proposed that site densities exhibited a distance-decay function that might be normally distributed with respect to distance from springs. He also suggests that spring use may have been of at least two kinds, with some springs reserved primarily for hunting while others served as settlement foci, providing water and vegetation. This behavior would result in different site types at some springs (Coombs 1979d:7).

Research Questions

In the absence of a single regional state plan pertaining to the Mojave Desert, research questions and priorities have been identified by consultants in the private sector. Until the Fort Irwin Archaeological Project was under way and developed a substantial research orientation and set of guidelines, the priorities identified were those pertaining to specific projects that had very narrow foci. In instances where projects might affect a small number of sites representing, say, the Protohistoric cultural period, then the research questions were defined as efforts to identify and refine information from that cultural period.

Research questions for the region remain largely implicit, but all are based on cultural-ecological concerns that focus on man-land relationships and economy. The latter are largely perceived as almost coterminous with subsistence. Inventories structured as dispersed probability samples are ill-suited to collecting data on settlement patterns, one of the key sets of information essential to regional research questions. The difficulty of assigning sites to chronological periods that characterizes the Mojave region also hampers this kind of approach. Yet overview after overview in the region falls back on settlement-subsistence system investigation as research justification for archaeological inventory, whatever its intensity.

Response to environmental change is a central research issue in an arid environment with a long record of hunter-gatherer occupation. The lack of progress in understanding Holocene climatic and environmental conditions and changes is perhaps the most serious and frustrating problem facing archaeologists working in this region. A recent synthesis (Weide 1982) reflects the inadequate extent of current, pertinent work in the area. Weide (1982:24) called for "systematic long-term programs of interdisciplinary study" and recognized that archaeology provides "a major impetus for attempting this kind of research." Paleoenvironmental research is something of a stepchild in CRM studies, however, for no matter how crucial it is to a research design, the apparent intent of cultural resources law is toward the protection or recovery of cultural data; environmental studies too often come out second-best in the competition for limited funds.

For example, even though the Fort Irwin Archaeological Project has been a long-term program with emphasis on data recovery and a research design that centers on issues of changing relationships between cultures and their environment, it has not incorporated a systematic interdisciplinary study of crucial paleoenvironmental factors. Environmental studies have been sacrificed in budget-paring negotiation. When funded at all, short-term consulting stints placed researchers in a poor position to make substantive contributions to the project. Probably the best hope for improved environmental understanding in the region comes from the work of Spaulding (1983, 1984). He has worked on several regions in the Mojave as a consultant on CRM projects including FIAP in spring 1984, and has a substantial background of related research in the region.

CRM work in the region has also made apparent the lack of systematics suited for dealing with ceramics in the area. Interest in ceramics comes from issues of late prehistoric ethno-linguistic distributions, from questions regarding the role of trade and exchange, or simply from attempts to use pottery types as chronological indicators (Jenkins 1984).

The FIAP research design (Warren 1984b) places its research priorities in two relatively long temporal spans: "Early Times"--the Lake Mojave and Pinto periods; and "Late Times"--the Saratoga Springs and Protohistoric periods. It also identifies areas of Fort Irwin that are accorded high priority for research regarding these two time periods. The subsistence focus model leads to analytic priorities being concentrated on changing technology. Site distributions are also addressed from a settlement pattern perspective (Kelly and Warren 1984), and the stream of lithic procurement and reduction technology serves to relate many of the sites within the fort (Bergin and Warren 1983; Skinner 1984). At Fort Irwin, the broad sweep of damage leads to regional studies at the scale of whole basins or drainages (with the rugged terrain of the upland omitted), permitting a better approach to settlement-subsistence systems by fostering examination of whole systems, or at least substantial subsystems.

The cultural resource projects conducted in the Mojave Desert do represent a series of progressive steps in developing regional research orientations and analytic techniques in the sense that cumulative knowledge is developing from successive projects. The Intermountain Power Project

(Macko et al. 1983) has complemented important developments of the Fort Irwin Archaeological Project. The resources available on Fort Irwin for analysis and discussion of Mojave Desert cultural evolution are limited despite the huge area covered by the installation. The Intermountain Power Project, which traverses the Mojave Desert from Stateline, Nevada, to Victorville, California, crosses diverse environmental zones and encounters cultural resources which are not as well represented in Fort Irwin.

Of particular concern to the Intermountain Power Project was the intensive study of quarries. The Intermountain Power Project included an intensive study of quarries, at present unparalleled in North America. Of particular interest to Great Basin archaeology is the development of cation-ratio dating curves as part of the Intermountain Power Project. This technique has extremely significant implications for research priorities. The most common cultural resource in the desert, the lithic scatter, can in many cases be chronometrically dated with the cation-ratio dating curve developed by Applied Conservation Technology (ACT) in conjunction with Dorn. The ACT dating curve (Dorn et al. in press) has already been used by another researcher (Whitley 1984), although his application of the curve was premature. The results of the dating of chipped-stone reduction sequences will be reported soon, but the approach and technique are available now.

Regional Planning

The cautious approach of the California SHPO to resource protection planning has resulted in a diverse, uncoordinated development of archaeological CRM research in the Mojave Desert. The BLM, China Lake Naval Weapons Center, the National Training Center at Fort Irwin, and Death Valley National Monument all have substantial, but idiosyncratic archaeological programs. At present these agencies are under no obligation to articulate their programs with one another, or with any larger plan. There is doubt that site and environmental data are being accumulated in a sufficiently consistent fashion to permit future coding and analysis of patterns of site location on a region-wide basis. On the other hand, throughout the Mojave Desert, the settlement systems resemble those in other parts of the Great Basin, in that settlement locations are strongly influenced by availability of water and concentrations of particular plants. It is clear that the Mojave Desert is as amenable to predictive studies as is the rest of the Great Basin. The uncoordinated approaches of the numerous agencies with jurisdiction over substantial tracts of land have not fostered progress in this direction. The absence of unified site recording and encoding means that vast amounts of site inventory data from the first 10 years of the CRM era in the Mojave Desert will probably remain scientifically indigestible for the foreseeable future.

Communication with Native Americans

Native American involvement in Mojave Desert cultural resource studies began in a large way in the mid-1970s with consultation as part of the Desert Plan Class I and II cultural resource studies. Archaeological Research, Inc. conducted interviews with Southern Paiute people at Pahrump, in attempting to incorporate Native American values into significance

assessments (Coombs 1979b:128-129). Since then, Native American involvement has been standard operating procedure during excavation programs; some CRM firms make it standard policy to incorporate Native Americans at all levels to ensure proper information flow and management. This is in addition to the controls specified by the Archaeological Resources Protection Act (ARPA).

In some cases Native Americans have chosen to not be involved for cultural reasons. For instance, the Colorado River Indian Tribal Council declared it would not involve itself with CRM studies on Fort Irwin. But in general, archaeologists and Native Americans in the Mojave region have developed a working reciprocity based on a preservation ethic.

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Fig. 1. The Inyo/Mono and Surprise Valley/Honey Lake Subregions.

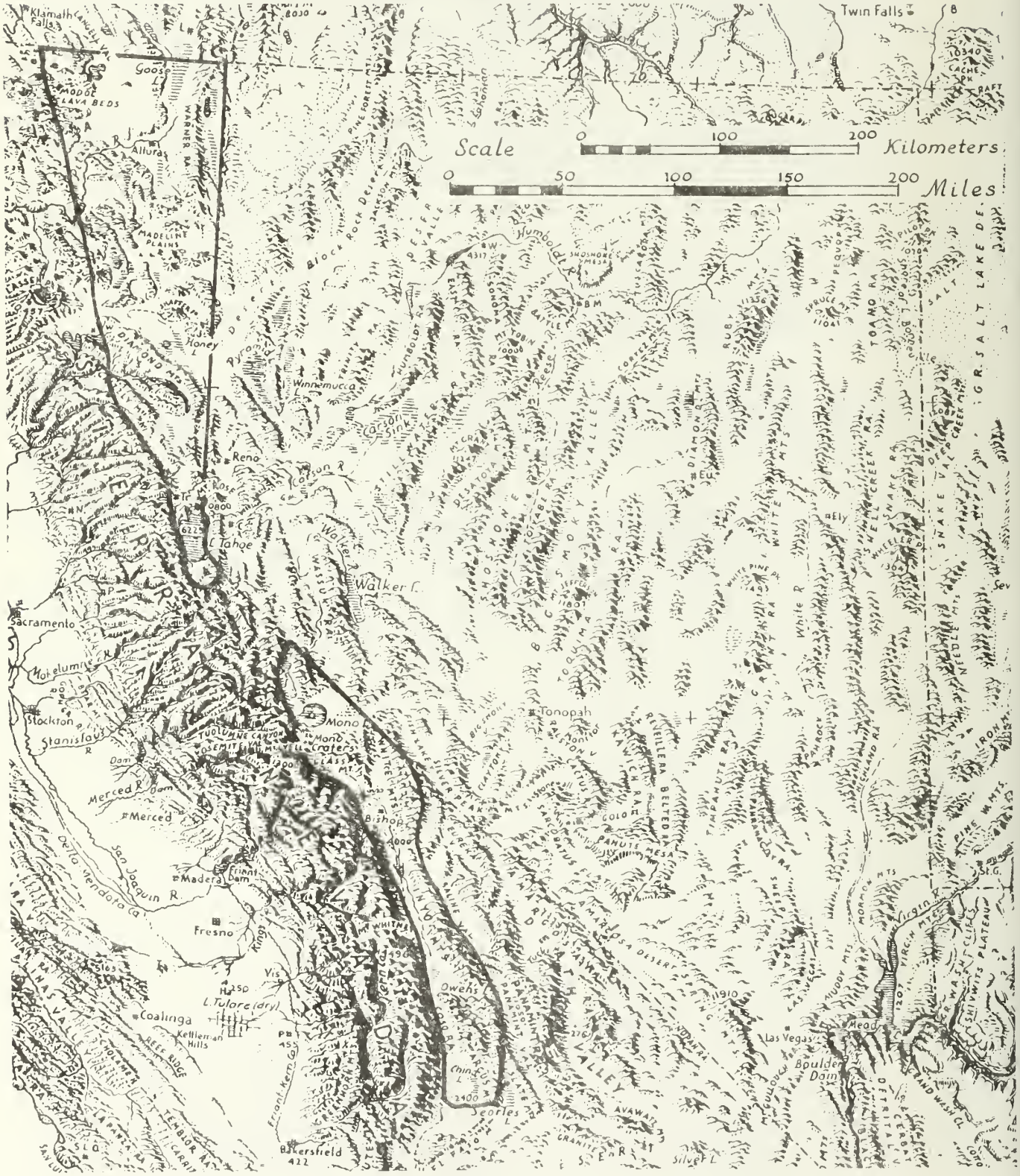

Fig. 1. The Surprise Valley-Honey Lake and Mono-Inyo Subregions.

THE GREAT BASIN IN CALIFORNIA: THE INYO-MONO AND SURPRISE VALLEY-HONEY LAKE SUBREGIONS

by

Robert L. Bettinger and Christopher Raven

Subregions

The subregions in question here include those parts of California lying within the geographical boundaries of the Great Basin north of the Mojave Desert (Fig. 1). The eastern boundary is thus the California/Nevada border, the northern boundary the California/Oregon border. The common western boundary for the entire subregion is the eastern slope of the Sierra/Cascade range, west of which lies the culture province of California. The southern boundary follows the crest of the Inyo Mountains, which flank the eastern margin of southern Owens Valley, and the Coso range, which mark the southern end of Owens Valley. Although in part an arbitrary line, this southern boundary follows a vegetative division between the creosote (Larrea tridentata) dominated scrublands of the Mojave desert and the shadscale (Atriplex)/sagebrush (Artemisia tridentata) desert scrub of the Great Basin, including Owens Valley and other areas to the north along the eastern Sierra/Cascade front.

For the most part, the Sierra Nevada highlands are excluded from consideration here. As between any two adjacent regions, there are clear cultural connections between prehistoric developments in the Sierra Nevada and the Great Basin. Nevertheless developments in these two areas are in some sense distinct, particularly in the central Sierra Nevada. Further, the higher reaches of the Sierra Nevada differ both climatically and vegetatively from the Great Basin and on these grounds alone they are properly left to the Californianists.

Within the narrow remaining sliver that is Great Basin California there are two geographically separate and in many respects environmentally and culturally different areas: the Inyo-Mono subregion and the Honey Lake/Surprise Valley subregion.

The Inyo-Mono subregion as defined by Bettinger (1982) includes Owens Valley, Long Valley, the Mono Basin, Fish Lake Valley, Deep Springs Valley, Eureka Valley, and Saline Valley. The last four lie to the east of the Inyo-White range and are excluded here because they either are included in the Mojave Desert subregion as described by Lyneis (this volume) or fall partly or wholly in Nevada. Interconnected in the sense of sharing the same Pleistocene drainage, the remaining three valleys (Owens, Long, and Mono) are today subject to essentially identical forces of climate and exhibit broadly similar biotic communities (cf. Bettinger 1982). All parts of the Inyo-Mono region sustain at least moderately dense stands of the ethnographically important nut tree Pinus monophylla, the pinyon pine.

Within this region two federal agencies and one private agency own or control most of the land. These are the U.S. Forest Service (Inyo National

Forest), the U.S. Department of Interior Bureau of Land Management (Bishop Office of the Bakersfield District), and the City of Los Angeles Department of Power and Light. Individual private ownership is concentrated principally around the large and small towns.

The Honey Lake/Surprise Valley subregion, which contains just these two important areas, likewise exhibits a broad uniformity of climate and environment. Unlike the Inyo-Mono region, however, it lies north of the modern distribution of the pinyon pine, which in addition to other features distinguishes it from the Inyo-Mono region.

In ethnographic times, both the Inyo-Mono region and the Honey Lake/Surprise Valley region were occupied chiefly by Numic speaking groups, the former by both Mono and Northern Paiute speakers, the latter by Northern Paiute and by the Washo, speakers of a Hokan language. Whether in the Inyo-Mono region or the Honey Lake/Surprise Valley region, the Northern Paiute were loosely segregated in food-named groups defined principally on the basis of residence. The kutzabidikadi (fly-larvae eaters) of the Mono Basin, the wadakuht (seepweed eaters) of Honey Lake, the gidutikadu (marmot eaters) of Surprise Valley, and the kamodokado (jackrabbit eaters) lying between the last two, are the more notable of these. The Mono speaking groups of the Inyo-Mono region were confined to the area south of the Mono Basin, and in Owens Valley were segregated into localized groups more complexly organized than the simple Northern Paiute bands.

The culture history of the Inyo-Mono region was initially outlined by Lanning (1963) and subsequent research, most notably by Bettinger (various), Davis (1964), and Hall (1983) has given no reason to substantially alter the sequence he defined. The evidence for early occupation turns on the recovery from many localities of Lake Mojave, Silver Lake, and Clovis-like points, all of which fit comfortably within the Western Pluvial Lakes Tradition of Bedwell (1973). None of this material is securely dated but ages on the order of 7000-8000 B.C. for the oldest of it seem reasonable. The age of the youngest material, which would certainly include the stemmed projectile point forms but perhaps not the concave-based forms, is equally speculative. This is in part owing to disputes regarding dating of the sequent Pinto/Little Lake complex, which on the basis of extant evidence followed without any perceptible break in time. Many would date the Pinto/Little lake material no earlier than about 2500 B.C., certainly no earlier than 3500 B.C. This date would thus constitute the close of the Western Pluvial Lakes Tradition. Others would place the Pinto material as far back as 5000 B.C., in turn pushing the WPL materials that much further back in time. In the Honey Lake/Surprise Valley region, the Pinto/Little Lake (there Bare Creek) material can scarcely be much older than 2500 B.C., as the diagnostic point types are preceded by large side-notched points (cf. Northern Side-notched, Bitterroot Side-notched) which are securely dated to the interval between 5000 and 2500 B.C.

Whatever the ultimate resolution of this problem, by 2500 B.C. both regions exhibit archaeological manifestations characterized by stemmed, indented-base points of the Pinto/Little Lake type. In the Surprise Valley region, the settlement pattern is at this time (Bare Creek phase) characterized by large lowland settlements occupied nearly year-round and a

variety of upland and lowland temporary camps used for more specialized purposes. The Bare Creek settlements feature the typical Great Basin brush-covered wickiup and faunal remains suggesting reliance on small, as opposed to large, game. This replaces the earlier Menlo phase pattern, in which houses are large and semi-subterranean like those noted ethnographically along the Columbia, and in which large mammals figured prominently in the diet. A shift toward warmer, drier climates may explain both changes in the sense that a less productive environment would encourage more frequent movement and less elaborate houses, while at the same time reducing the quantity of available game. The less elaborate houses and general character of subsistence patterns that characterize the Bare Creek phase evidently persisted into historic times in this area (O'Connell and Hayward 1972).

In Owens Valley, the Pinto/Little Lake components (Clyde phase) constitute evidence of the first extensive occupation of the region. By this is meant a pattern of occupation that results in regularly occurring (and readily recognized) archaeological manifestations. The complete settlement pattern is unclear but in some areas it certainly included as one aspect large, intensively occupied camps. These may represent permanent villages (Bettinger 1977a) or, what now seems more likely, the anchor points for extensive seasonal rounds--winter camps, for example.

In both Surprise Valley and Owens Valley, the Pinto/Little Lake point forms are replaced by Elko series points (large, triangular and corner-notched or eared forms) at about 1200 B.C. What evidence is available from both areas suggests subsistence-settlement patterns essentially comparable to those of Little Lake times.

At approximately A.D. 600, in both Surprise Valley and Owens Valley, the Elko series of projectile points is replaced by smaller forms of the Rose Spring and Eastgate series (Rosegate series) which, being diminutive versions of the Elko series, evidently mark the adoption of the bow and arrow by peoples in both regions. In Owens Valley, it is at this time that the large, permanent village known from ethnographic accounts (Steward 1933) makes its first clear appearance. It is also at this time that there is clear archaeological evidence of the intensive use of the pinyon pine as a food resource; both patterns, however, very likely originated somewhat earlier, perhaps around 0 B.C./A.D., and merely became common enough to be visible by this later time. The remaining archaeological sequence of Owens Valley is distinguished by increasing centralization of settlement patterns and by increasingly intensive use of resources. Neither Long Valley nor the Mono Basin are sufficiently well studied to permit comparable observations about them but it is at least clear that the centralized pattern found in Owens Valley does not extend to them and that the history of both is intimately tied up with the fortunes of long-distance trade in the obsidian with which these areas are so richly endowed.

It cannot be disputed that the recent spread of Numic speakers out of the southern Sierra Nevada (if the linguists are to be believed) would have had a substantial effect on the areas in question here. To date, however, except for the intriguing proposal of Bettinger and Baumhoff (1982) little

archaeological work has been done on this problem and that which has been done generally misses the mark.

California State Plan

The California Office of Historic Preservation is currently developing a mechanism through which a state plan for cultural resources will be formed. In general, this will follow the guidelines set forth for such plans by the Secretary of the Interior, commonly known as RP-3 (Resource Protection and Planning Process). These are in part resultant from the work of one of the present authors (Bettinger).

In large part the need for such plans grew from problems in applying and evaluating the criteria of "significance" upon which cultural resources were judged in terms of their eligibility for nomination to the National Register. In the absence of any uniform criteria by which sites from a given area were to be evaluated, considerations of such eligibility were inherently idiosyncratic and uneven in quality, depending more on the expertise and interests of those submitting properties for evaluation than on the archaeological qualities of those properties. The RP-3 concept is an attempt to introduce a modicum of standardization to this process by recognizing that the concept of "significance" is inherently variable in its meaning and hence not subject to absolute definition or standard specific definition at the national level. That is, except in a few very special circumstances, there can be no national standard by which a site may be judged to have or to lack "significance." The quality of significance, rather, must be judged in the context of regional research programs and problems into which a given cultural entity may or may not fit.

To this end, state plans are intended to isolate appropriate regional criteria by which significance can be determined. Just as there can be no national standard of significance, however, neither can there be a single state standard of significance. Or at least this need not be necessarily so, especially in states that are very large and culturally diverse, such as California. Therefore, just as the federal government delegated to the responsibility of ascertaining standards of eligibility and significance to the various states, so the states under RP-3 delegate to smaller, more culturally, environmentally, archaeologically, and historically homogeneous spatial units the responsibility for determining standards of significance for those units. These standards are defined in terms of certain areas of broad interest and importance, or problems. In the language used, the effort is to define "study units" (i.e., temporally, spatially, and organizationally defined topics of inquiry). Thus a property is to be judged for its significance in terms of one or more such "study units." As individual study units seldom exhibit coterminous spatial boundaries and will be too numerous to manage individually, "management units" will also be defined. To the extent possible, these will gather within their boundaries a set of study units with a common geographical emphasis.

The first step in the development of a state plan involves the definition of study units. This step is to be organized by one or more

individuals in each of the management units, who will convene workshops of knowledgeable individuals. The workshops will, in turn, attempt to isolate basic areas of interest that will ultimately define study units. Together, those in charge of the management units will articulate study units that bridge individual management units.

This planning process is still in its preliminary stages in California. Management unit planners have been named but individual management unit workshops have yet to be held. Two years is probably a minimum time required to complete the entire process from management study unit definition to inter-management unit articulation of a coherent state plan.

Site Records

Prehistoric site records for the Inyo-Mono region are maintained by the Eastern Information Center, Archaeological Research Unit, Department of Anthropology, University of California, Riverside, CA 92521. This is an arm of the California Archaeological Inventory, which is in turn supported by the SHPO. Daniel McCarthy is the current Inventory Officer for the Eastern Information Center and is partly supported by funds provided by the SHPO. There are currently 2000 site records for Mono County and another 2800 for Inyo County. Each site is designated by the standard trinomial identification (State, County, Site Number) and is entered on a master map that indicates site location and areas known to have been surveyed. The quality of individual records varies according to the predilections of submittants. The worst consist only of cryptic descriptions and references to a map location. More recent records are generally entered on the standard California State Department of Parks and Recreation Archaeological Site Form, a two-page affair covering basic environmental and archaeological information and location by either UTM or legal boundaries (township/range).

The major agencies responsible for cultural resource management in the Inyo-Mono region routinely submit site records to the Eastern Information Center, but disagreement over basic policy in regard to these forms has in some notable cases caused this flow to be interrupted. For a nominal sum, the Eastern Information Center conducts record searches for qualified individuals who are seeking to document the presence of archaeological sites or the nature of previous archaeological survey in specific areas.

In addition to individual site records, the Eastern Information Center maintains a file of documents pertaining to the conduct of archaeological research in both Inyo and Mono Counties. Consisting largely of unpublished cultural resource reports, this file is a valuable source of information regarding the nature of reported archaeological research for any given locality. Currently, there are some 2,200 manuscripts in this file, but the total includes, in addition to manuscripts pertaining to Inyo and Mono counties, papers relating to Riverside County.

At present, there is no uniform, statewide provision for historical records. In some areas of the state, such records are maintained by historical societies and similar associations, but insofar as could be

determined at this writing, none are currently being collected in any coherent fashion for the Inyo-Mono region. The Eastern Information Center routinely forwards historic records to the SHPO.

Archaeological site records for both Surprise Valley and the Honey Lake Basin are filed at the Northeastern Information Center of the California Archaeological Site Inventory, Department of Anthropology, California State University, Chico, CA 95929; Dr. Makoto Kowta is current Coordinator of the Center. When site records are assigned trinomial discriminators and are keyed to an atlas of site locations and survey areas, they become permanent elements of the data base recognized by the California Office of Historic Preservation. As of this writing, the Center lists over 1200 sites for Lassen County and over 1800 for Modoc County, although these figures represent many sites lying west of the Great Basin boundary.

Current submissions to the site catalogue derive principally from the planning and project-related surveys conducted by public agencies charged with responsibility for managing the greater portion of the land base. Particularly, the Bureau of Land Management (Cedarville, CA 96104) and the Modoc National Forest (Alturas, CA 96101) contribute site data from the Surprise Valley vicinity, while the Lassen National Forest and Bureau of Land Management (both in Susanville, CA 96130) are responsible for cultural resources in the Honey Lake Basin. In practice, the submission of site records lags recording time by a factor ranging from a few months to more than a year; consequently, records of the known resources of any geographic tract should be sought both at the Chico repository and at the appropriate land management agency.

Temporary numerical designations are assigned by the agencies for identification until submission to the Chico repository; the Forest Service employs a digital system that identifies sites sequentially within administrative units (region, forest, ranger district), while the local offices of the BLM employ a geographically-based system that identifies sites sequentially by township, range, and section. The latter system has the advantage of grouping archived records closely on the basis of the geographic proximity of sites, rendering areal searches easy and efficient. Too, the system substantially facilitates manual sorting for geographic data retrieval.

Informal repositories of site data include the Modoc County Historical Society Museum (Alturas) and the Lassen County Historical Society Museum (Susanville). Neither facility is staffed or equipped to serve as a comprehensive regional archive; however, owing to their frequent interaction with the public, both can occasionally provide information that has not yet been consolidated in more structured recording systems. Such information is most effectively elicited from the current museum curators.

Cultural Resource Management Collections Repositories

At the time of this writing, there are no Cultural Resource Management collections repositories for projects within the Inyo-Mono region. Collections made in the course of such work generally fall under the curatorial

responsibility of the organization undertaking the project. There is a move afoot by some agencies, for example the California Department of Transportation, to establish de facto repositories at certain institutions having the requisite museum storage and staff with known interests in the region. There have been requests, for example, that the University of California, Davis, Museum of Anthropology consider assuming curatorial responsibility for collections forthcoming from specific projects in Owens Valley. For the most part, however, the history of cultural resource management in eastern California is such that universities with long-term research interests in the Inyo-Mono subregion have done most of the work and have actively sought to assume curatorial responsibility for the resulting collections.

In principle, the major agencies involved in cultural resource management in the Inyo-Mono region are committed to the development of a local archaeological collection repository in the Paiute-Shoshoni Cultural Center in Bishop. Given recent cool relations between archaeologists and Native Americans, activation of this program is being approached with caution, and its implementation currently awaits the appointment of a qualified curator to the staff of the center.

Paralleling the diverse origins of individuals who have conducted archaeological research in the Inyo-Mono region, there are major archaeological and ethnological collections from this region scattered in institutions throughout the western United States. Smaller collections are as far away as New York. The Universities of California at Berkeley (Lowie Museum), Los Angeles, Davis, and Riverside currently maintain the largest of these. The most important individual collections are perhaps those from the Rose Spring, Iny-372, and Cottonwood Creek (Iny-2) sites (Berkeley) and from Mno-382 and Mammoth Junction (Los Angeles). The Southwest Museum of Man, Los Angeles, a private institution long quiescent but recently coming to life again vigorously has several collections from this area; the most notable of these is the one from the Stahl Site at Little Lake (Harrington 1957).

Locally, the Eastern California Museum, 155 Grant, Independence, CA 93526, has an extensive collection of archaeological and ethnographic specimens. Many of these have been donated by amateur collectors, most of them local citizens. In 1931 Clifford Park Baldwin surveyed a portion of southern Inyo County; he recovered some quantity of perishable material from caves and shelters, and prepared a brief report of this work (Irwin 1980). This and other material is presently housed at the Eastern California Museum.

In addition to these collections of traditional ethnographic and archaeological materials, there are, at a number of locations, collections of important documentary information pertinent to the recent culture history of the Inyo-Mono region. Perhaps the most remarkable of these is the photographic collection of one A. A. Forbes (now at the Los Angeles County Museum of Natural History), who maintained a photographic studio in Bishop, California, between about 1902 and 1916. In the course of his work and travels throughout eastern California he obtained many pictures of the native inhabitants. At least two other photographic studios, those of

"Dietrich" and of H. W. Mendenhall, obtained images of ethnographic interest, but the location of their complete works, should they still exist, are uncertain. Examples of the work of all three are to be found in Steward (1933).

The most extensive collection of unpublished ethnographic notes dealing with the region are at the Bancroft Library, University of California, Berkeley. Other than this, the narratives of W. A. Von Schmidt, who mapped the Inyo-Mono region in 1855-1856 under contract with the U.S. Government, provide the most useful source of documentary evidence relevant to the precontact landscape of this region. They include occasional references to native groups and practices (cf. Lawton et al. 1976).

Collections made during the course of cultural resource projects in Surprise Valley and the Honey Lake Basin customarily receive curation through the institutional affiliations or ad hoc arrangements of contractors. As a consequence, although relatively little work has been done in the region, its tangible by-products are dispersed. The principal collections are held by the University Museum, California State University, Chico; the R. H. Lowie Museum, University of California, Berkeley; the Museum of Anthropology, University of California, Davis; the Desert Research Institute, Reno; and the Nevada State Museum, Carson City. Small collections from the Honey Lake Basin likewise are maintained by the California Department of Parks and Recreation (Sacramento). Materials accumulated in-house by Federal agencies generally have been directed to Chico, although the Modoc National Forest recently has explored curatorial arrangements with the Modoc County Historical Society Museum (Alturas) in the interest of providing a local repository within the area of research. Members of the Fort Bidwell Indian Reservation have expressed interest in the establishment of an autonomous museum of Surprise Valley archaeology and ethnography, but funding and the development of the requisite expertise for such a venture are several years off.

Many important collections were assembled during the years preceding the National Environmental Policy Act (NEPA) and the rise of CRM; from these, the principal articulations of the local culture-historical sequence were first defined. The most significant collections are those from Tommy Tucker Cave (Las-1), the Karlo site (Las-7), the Rodriguez site (Las-194), the Menlo Baths site (Mod-197), and the King's Dog site (Mod-204), all of which reside in the R. H. Lowie Museum (UC Berkeley), and that from Bare Cave, currently at UC Davis.

In a few instances, important private (i.e., non-professionally retrieved) collections have been acquired by public institutions or by private institutions that allow public access. The Lassen County Historical Society Museum (Susanville), the Modoc County Historical Society Museum (Alturas), and the California Department of Parks and Recreation (Sacramento) all house such collections in-state. The Favell Museum of Indian Artifacts and Art (Klamath Falls, Oregon) maintains an enormous collection from the northwestern Great Basin and southeastern Plateau, some of which is believed to have been collected in Surprise Valley. In all such cases, ascribed proveniences should be regarded as provisional at best.

Important ethnographic notes and photographs, especially the C. Hart Merriam Collection, are held at the Bancroft Library, University of California, Berkeley. Smaller collections, but including many items not duplicated in the Bancroft materials, may be found in the Lassen and Modoc County Historical Society Museums.

Survey Data

Intensive surveys of the Inyo-Mono region began with Meighan's (1955) examination of five separate parcels of land in Mono County. Prior to this, Harry Riddell, J. H. Steward, M. R. Harrington, E. Campbell and perhaps a few others periodically engaged in broad regional reconnaissance, but generally without any clear plan of attack. As noted by Bettinger (1982), whose summary of archaeological research in the Inyo-Mono region should be consulted, Meighan's work was followed by that of E. L. Davis (1964), whose principal concern lay with the identification of distinct settlement types in the Mono Basin and Long Valley. Research in this area slackened perceptibly in the late 1960s and began again in earnest with the work of Bettinger in the early 1970s. Since then, broad regional surveys have been undertaken throughout the Inyo-Mono region, the most important of which can be briefly mentioned. Within Owens Valley proper, Bettinger (1975, 1977a) has sampled a transect in central Owens Valley by means of randomly placed 500 m. quadrats. The Bureau of Land Management has also undertaken probabilistic samples of its holdings in Owens Valley (which tend to occur in the foothills on either side of the valley) and in the Benton Range. In Long Valley, Bettinger (1977c) has probabilistically sampled with 500 m. quadrats, and several large timber tracts have been surveyed in their entirety by R. Jackson and by the University of Nevada, Las Vegas. In the Mono Basin there have been probabilistic surveys in what have been designated the USBLM Bodie and Colville Planning Units by Basin Research Inc. (Busby et al. 1980), and in the Bodie Hills Geothermal Area by Hall (1980). Numerous strip surveys done in connection with powerline and highway rights-of-way comprise the balance of the major surveys in the region (see Busby et al. 1980).

It is difficult to summarize the nature of coverage that these surveys provide. It is known that in the Inyo National Forest, approximately 50% of the timbered land has been subjected to some sort of survey. By contrast, only 6% of the untimbered land has been examined in this fashion. In combination, these surveys cover some 117,000 acres. Comparable data are not available for the Bureau of Land Management. In general, the gaps are consistently in areas lacking in commercial value: the higher reaches of the desert ranges east of the Sierra Nevada, monotonous stretches of unwatered scrubland, and so on. Valuable timber stands, recreational areas, and corridors of access, by contrast, are consistently slated for development and thus funding is made available to study them. Areally, this has meant that Owens Valley, the Benton Range, and Long Valley are relatively well studied, for they are the areas where commercial development of one sort or another has centered or where academic interest has tended to concentrate. Local amateurs, principally H. Riddell and G. and R. Enfield, have contributed substantially to this survey information. The

Mono Basin, on the other hand, is far less well known. Bridgeport Valley, just north of the Mono Basin and at the very margin of the area considered here, remains almost entirely unstudied. It is largely in private hands and its primary use (ranching) has been stable and not given to the development noted in many parts of the eastern Sierra Nevada. Further, it has received little academic attention.

The general lessons that have been learned in the course of our survey experiences in eastern California will not come as any surprise to those familiar with the recent literature on archaeological sampling. There is at least one disastrous case in which a systematic quadrat survey employed a sample interval that matched exactly the periodicity of landforms in an area so that the sample units all fell between major scarp edges and almost never on them. Too, upon careful inspection, many areas showed many more and larger sites than had been expected, others far fewer than expected. Particularly surprising in this regard are the results of recent transect surveys by Bettinger in the highest portions of the White Mountains. These have shown alpine sites to be as numerous and in some cases as large and rich as those in many lowland areas, a finding that is certainly counter-intuitive. In a general sense these surveys have been most useful, for it can be now said that as the result of extensive areal surveys very few parts of the Inyo-Mono region are terra incognita; while we are still far from understanding the whole of the archaeological record, we at least have some concept of what that record consists of.

In terms of the more practical utility of these surveys, the case is ambiguous. Certainly, the information gathered can be incorporated into "sensitivity maps." The BLM has done this, though the Forest Service has, for reasons outlined below, chosen not to. The problem with the utility of these surveys is that their worth is not absolute but relative. It is relative to the largest issue of what archaeology is "good for" in an abstract sense. And what archaeology is "good for," of course, determines how one translates survey data into sensitivity maps. Without an over-arching notion of purpose, survey data are just so much paper. They are potentially useful to one or two scholars interested in very narrow problems, but they are not of intrinsic value and certainly not the stuff from which spring meaningful sensitivity maps.

If there is any lesson at all to be learned from our survey experience in eastern California it is that the inventory approach and broad scale surveys do not result in an increased understanding of regional archaeology. What they result in it an increased ability to describe where some sites and some kinds of data occur on the landscape: not why they are or what they are but just where they are. Currently our sensitivity maps are, for the most part, really nothing more than distribution maps, and not even that, given the generally spotty coverage they reflect. And, "sensitivity" and "distribution" are not synonymous.

To underscore the point, in many instances large regional inventories undertaken in the Inyo-Mono subregion have not resulted in any published account of what was found or what was learned of relevance to our knowledge of regional prehistory.

Fortunately, the Inyo National Forest and the Bakersfield District of the BLM, which serve the Inyo-Mono subregion, are well aware of the above and both have spent a great deal of time and effort in developing regional cultural resource management plans. The BLM has set this down in its Management Framework Plan, and the Inyo National Forest is currently completing a similar document, the Forest Plan.

Sporadic survey data began to accumulate from the Honey Lake Basin almost immediately upon establishment of the California Archaeological Survey at UC Berkeley in 1948. Conducted chiefly by F. A. Riddell, the work consisted for the most part of the recording of known sites and the examination of promising locations. While hundreds of sites were recorded in this effort, little attempt was made to identify their distribution or frequency. It was not until the 1970s that any parcel of land in the area was subjected to intensive survey, and not until late in the decade that sampling programs began to attempt regional projections of site density. In Surprise Valley, O'Connell's (1975) pioneer work included a broadly-scaled regional reconnaissance that sought to characterize the environmental correlates of prehistoric site locations. But, lacking provision for the nonintuitive sampling of the study area, or for the intensive survey of any portions of it, the resulting models were based on impressionistic data.

In both Surprise Valley and the Honey Lake Basin, intensive survey awaited the response of federal agencies to NEPA and its offspring legislation. Since the early 1970s, both the U.S. Forest Service and the BLM have prefaced all of their major ground-disturbing activities with intensive surveys performed either on a contract basis or, increasingly, by in-house staff. As a result, several tracts comprising as much as 10,000 contiguous acres have been inventoried at close levels of scrutiny. Likewise, state agencies (especially the California Department of Transportation and the State Lands Commission) have engaged in pre-project compliance surveys.

As one element of its mandated planning system, the BLM has ventured into regional sampling programs for large planning areas in both Surprise Valley and the Honey Lake Basin. Such programs have employed various approaches to the stratification of study areas to generate maps of predicted site densities. Funding constraints have kept sampling fractions necessarily low, and constraints on time and work force have required various logistical expediencies in the selection of sampling unit size and dispersal. These have reduced the manipulability of the results, but a useful baseline has been established for future research. The reports of such efforts are incorporated in the Unit Resource Analyses for each Planning Unit, and are published, in summary form, in Environmental Impact Statements on the planning system (e.g., USDI-BLM 1979, 1980, 1981).

The chief bias, of course, in both project-related surveys and sampling programs, is their emphasis on federally-administered lands. Generally excluded from consideration because they are in private ownership are the rich agricultural bottom lands that dominate the centers of both Surprise Valley and the Honey Lake Basin, and many of the upland water sources that early became the bases of homesteads and ranches. A

predictable consequence of this selective focus is the systematic exclusion of some of the habitats most critical in prehistoric subsistence/settlement systems, including many that were favored as habitation locations. It seems unlikely that this imbalance will be overcome by federal agencies in the near future, owing to the nature of their funding structure, although a pilot sample survey of the Eagle Lake Basin northeast of Honey Lake (Corson and Smith 1979) achieved good results by ignoring land ownership patterns and jurisdictional boundaries.

The main problem in validating the utility of federal archaeology to the discipline (as opposed to land-use planners) lies in the inadequate dissemination of project results. The agencies involved in the Surprise Valley-Honey Lake subregion seldom have been able to fund staff time adequate for the preparation of professional reports, and have undertaken little by way of publication subsidy. Consequently, the product of much work is available to other researchers only in a relatively undigested form that, however much it may serve the momentary needs of cultural resource management, will require considerable processing before it can contribute much to a general understanding of local prehistory.

Environmental Data

Both the Bishop office of the BLM and the Inyo National Forest (both at 873 North Main, Bishop, CA 93414) have local specialists in soils, range management, vegetation, hydrology, wildlife, and the like. As a consequence of their efforts, each retains a substantial file of information including detailed maps and in some cases summary manuscripts. The BLM has integrated this information for its entire holdings into what are called Unit Resource Analyses. These classify each quarter-quarter section of its lands in four planning units (Benton, Bodie, Coleville, and Owens) in terms of its soils, wildlife, hydrology, archaeology, and so on.

The Forest Service has similar information for the entire Inyo National Forest and is currently compiling it in similar fashion for what it terms Capability Area Analyses. As with the BLM Unit Resource Analyses, once completed this information will allow any investigator to obtain detailed environmental information on virtually any plot of land within the Inyo-Mono subregion.

In addition the following sources of information are relevant.

Maps: U.S.G.S. 15' and 7.5' maps are available for the entire area. In addition, the Forest Service has produced and recently updated a smaller scale map of the entire region, showing ownership (BLM, USFS, Los Angeles Water and Power, and Private) and roads not appearing on USGS maps.

Aerial Photographs: The Forest Service has two sets of photographs for its holdings, one is large scale and in color, the other smaller scale and black/white. Indices for both may be obtained from the Forest Supervisors Office, Bishop, CA 93414.

Vegetation: The summary work of Storer and Usinger (1963), the flora of the White Mountains by Lloyd and Mitchell (1973) and the shorter work of DeDecker (1969), the acknowledged expert on central eastern California plants, are the best sources of information. The very competently organized "Waucoba News" of the Bishop Museum and Historical Society, edited by Enid Larson (Box 265, Big Pine, CA 93513) contains valuable information on current research and understanding of Inyo-Mono natural history including plants.

Geology/Geomorphology: Two very good guidebooks to the geology of the area from northern Owens Valley to the Mono Basin are Lipshie (1976) and Sheridan (1971). Both of these were developed for organized geological tours, provide detailed locational information and exact mileage for the localities discussed, and contain excellent bibliographies. More general discussions of regional geology are to be found in Hill (1975), Schumacher (1969, 1976), and Storer and Usinger (1963). The BLM has published a draft version of its soil inventory of the Benton-Owens Valley area, which runs from the Mono Basin to Owens Lake; information regarding it can be obtained from either the Bishop, Bakersfield, or Sacramento Offices of this agency.

Hydrology: Owing to its importance as a source of water for Los Angeles, the hydrology of the Inyo-Mono region is relatively well studied. Two useful sources of bibliographical information are Strojan and Romney (1979) and Joslin (1984).

Climate: Standard U.S. Weather Bureau summaries are available for numerous stations at varying elevations with varying slope aspects. Additionally, the high-altitude (two stations above 10,000 feet) weather records made by the University of California White Mountain Research Station (Pace et al. 1971) are of special interest. They are perhaps the single best source of data on alpine climates in North America.

Fauna: The most comprehensive summaries of contemporary faunal distributions are presented in the Waucoba News, in Storer and Usinger (1963), and in Schumacher (1969, 1976). The recently published work of Wehausen (1983) on White Mountain sheep is perhaps the most intensive study of this species within the Great Basin.

The most current environmental data on Surprise Valley and the Honey Lake Basin are housed in the offices of the Modoc National Forest (Alturas), the Lassen National Forest (Susanville), and the regional offices of the BLM (Susanville and Cedarville). Each office is staffed with resource specialists who have participated in the generation of the data base and who are responsible for updating it as planning and development require. Characteristically, such data are organized into geographic "packages" that reflect administrative subdivisions (e.g., ranger districts, planning units, and specially-designated resource management areas). The quality and quantity of data are unevenly distributed owing to the history of activity in the area. Local staffs are the best guides to the kinds and currency of the data available on any specific tract, and in many instances they may be able to inform the researcher of the schedule under which new data will be collected.

Specific existing data sources include the following:

Maps: All parts of the Honey Lake Basin and the northern half of Surprise Valley are depicted on USGS 15' maps; the southern half of Surprise Valley has been mapped in the 7.5' series, and the older 15' maps of the area have become difficult to acquire. Maps of northern Surprise Valley in 7.5' format were prepared by the California Department of Water Resources, but were never given general distribution; as they contain much information not contained on the USGS maps, they should be consulted where finer-grained detail is needed. Additionally, both areas are covered by the Army Map Service 1:250,000 series, and by planimetric maps available from the USFS and BLM.

Aerial Photographs: Most portions of the region are represented by aerial photo sets maintained by the local offices of the USFS and BLM; additional coverage, much of it overlapping or duplicating that of the principal agencies, is available in the Susanville and Cedarville offices of the U.S. Soil Conservation Service.

Geology/Geomorphology/Soils: Bailey (1966) provides the most synoptic geological overviews; classic regional treatments of local geology and geomorphology include monographs by Russell (1927a, 1927b), while numerous less technical guidebooks are available within the area (e.g., Hedel 1981). Detailed soil mapping has been performed by the Soil Conservation Service, although only that covering the Surprise Valley region has been published (Summerfield and Bagley 1974).

Vegetation: Useful general introductions to the character and composition of local plant communities have been presented by Anderson (1978) and the USDA-SCS (1965); far more site-specific data are encoded in the range and habitat inventories maintained by the USFS and BLM.

Fauna: Local wildlife populations and their movements are monitored annually by the USFS, BLM, California Department of Fish and Game, and U.S. Fish and Wildlife Service. The resulting wildlife inventories and regionally specific condition evaluations provide by far the most current and detailed appraisals of the faunal structure of the area, and serve as baselines for detecting short-term historic trends as well. Continuous updating renders specific citation superfluous; local USFS and BLM offices customarily command the most current inventory data.

Paleoenvironmental Information

Mehringer (1977) should be consulted as a source of general information regarding vegetational change, dendrochronology, tephrochronology, pollen sequences and the like. Individual works of special merit are as follows.

Dendrochronology/Dendroclimatology: The best summaries of the dendrochronology of the Inyo-Mono region are those of Ferguson (1964, 1969), who has worked with both big sagebrush (A. tridentata) and the high altitude conifers (P. flexilis, P. longaeva). LaMarche (1973,

1974) has employed both tree-rings and fossil tree-lines to generate perhaps the most detailed climatic summary for any area in North America.

Tephrochronology: The works of Wood (1977) and Hall (1983) are exceptionally useful guides to the recent volcanic history of the Inyo-Mono region. Of special interest here is the potential use of ash chronologies in archaeological dating and the relationship between volcanically-induced environmental change and aboriginal adaptive response.

Glacial History: The glacial history of the Inyo-Mono region is comparatively well-studied. In addition to the summaries of Lipshie (1976) and Sheridan (1971), the work of Curry (1969, 1971) should be consulted. Curry (1969) is a particularly useful discussion of the relationship between glacial history and climatic change.

Vegetative Succession and Palynology: Relatively little of the work done is published. Mehringer (1977) is the best source in relation to the available literature.

Fauna: Virtually nothing is available on the faunal history of the Inyo-mono region. D. K. Grayson and M. E. Basgall have worked recently with the late Holocene archaeofaunas of central and southern Owens Valley, but in general the data are quite scanty.

Little work in paleoenvironmental reconstruction has been performed specifically within Surprise Valley or the Honey Lake Basin; paleoecological models of prehistoric adaptive strategies, then, have been reliant largely on the relevance of studies in surrounding regions. Local lacustrine history was addressed by Russell (1927b) and, at a more general level, by Hubbs and Miller (1948) and J. Davis (1982). Tephrochronology of the area was incorporated by J. Davis (1978) in his synthesis of a much larger region. O'Connell and Hayward (1972) inferred climatic and biotic changes from excavated Surprise Valley faunal sequences, but their analysis relied on a necessarily slender data base. Further paleoenvironmental research in the area is not known to be contemplated currently.

Summaries and Syntheses

Unfortunately, there are very few summary works on the archaeology of the Inyo-Mono subregion. Warren's (1984) recent summary of California desert archaeology is useful as a point of departure, but is slanted more toward the Mojave Desert and gives little space to Long Valley and the Mono Basin. Elston's (1982) summary of western Great Basin prehistory should also be consulted. It concentrates on areas from Owen Valley north and gives special attention to cultural resource management research. As a primer, the reader interested in the archaeology of the Inyo-Mono region should perhaps begin with Lanning's (1963) report on the Rose Spring Site, Iny-372, which provided the anchor sequence for Great Basin projectile points. In this now-classic piece, Lanning synthesizes earlier archaeological research in the Inyo-Mono region and draws temporal correspondences

between the Inyo-Mono sequence and sequences developed in other portions of western North America. Steward (1933, 1938) is, of course, the best summary source on regional ethnography. Chalfant (1933) is perhaps the most comprehensive discussion of regional history.

Perhaps the most ambitious attempt to summarize the ethnography and archaeology of the Inyo-Mono subregion is the recent monograph of Bettinger (1982). This work presents an historical sketch of regional research and attempts to synthesize the information recovered by surveys and excavations into models of subsistence-settlement sequences over time in each of the major subareas of the Inyo-Mono region. More detailed treatments of certain of these sequences can be found in Bettinger (1976, 1977c). Busby et al. (1980) should be consulted for more detailed, but less interpretively synthetic, summaries of regional chronologies, ethnographic research, and contact period history.

Processual models of regional prehistory vastly outnumber simple synthetic works. Among the more notable works are those of Singer and Ericson (1977) and Bouey and Basgall (1984) on the rise and fall of trans-Sierran obsidian procurement and exchange. Hall (1983) is an important study of the relationship between volcanic activity and prehistoric human occupation in the Long Valley/Mono Basin. Without question the most controversial pieces are those set forth by Bettinger in relation to the development of pinyon exploitation (1976), changing settlement and subsistence patterns (1977a), regional adaptive strategies (1978), and the origin and spread of Numic speaking groups (Bettinger and Baumhoff 1982). Each of these works has attracted criticism (McGuire and Garfinkel 1976; Madsen 1981; Munday and Lincoln 1979; Lyneis 1978; Simms 1982) to which Bettinger has invariably replied (Bettinger 1977d, 1979a, 1981a, 1981b; Bettinger and Baumhoff 1983). As Warren (1984) points out, whether or not one accepts the views set forth in these papers, comments, and replies, the ideas merit consideration and have served to stimulate research. It is in relation to the broader questions raised in these debates that future culture resource management archaeology in the Inyo-Mono region might profitably address itself.

The archaeology of the Surprise Valley and Honey Lake Basin subregion has been summarized in a number of formats. Because of the relatively small volume of primary research that has been performed in the vicinity, most syntheses have relied largely on the work of O'Connell and Riddell for basic sequences and problem orientations. The short treatment by Raven (1984) attempts to set work in the area into an historical perspective of trends in northeastern California archaeology; a more extended discussion by Jensen and Reed (1979) integrates culture-historical data from most of northeastern and central northern California. Portions of the area have been treated in cultural resource overviews of the Lassen National Forest (Johnston and Budy 1982), BLM lands in Lassen and Modoc Counties (Theodoratus Cultural Research 1979), and the Sierra Army Depot (Cleland et al. 1984). Elston (1982) and Aikens (1982) include data from the region in concise thematic summaries of the prehistory of the western and northern Great Basin.

The principal ethnographic sources include Kelly (1932) on the Surprise Valley Paiute, Riddell's (1960) ethnography of the Honey Lake Paiute, and Evans' (1978) notes on the Honey Lake Maidu. Important historical summaries include Fairfield's (1916) encyclopedic chronicle of the early days of Lassen County, W. Davis' (1974) and Pease's (1965) regional studies of northeastern California, and Roberts' (1980) historical overview of BLM lands.

No overall synthesis of the archaeology, ethnography, ethnohistory, and prehistory of the California segment of the northwestern Great Basin has been produced. Nor, as of this writing, is any such effort known to be contemplated. A more manageable frame of reference would seem to be what Olmstead (1957) referred to as "the California-Nevada-Oregon border triangle," with subdivisions along state lines observed only insofar as those actually have affected regional economics, demography, and political history.

Specifically problem-oriented studies in the region have been infrequent. Aside from the basic issue of sequence-building, processual models of prehistory in the Surprise Valley vicinity are limited to O'Connell's long term investigations of subsistence/settlement systems (O'Connell 1975), environmentally induced adaptations (O'Connell and Hayward 1972), and the implications of detected changes in residential structures (O'Connell and Ericson 1974). Also important is Hughes' (1983) work on local obsidian procurement and exchange networks. The Honey Lake Basin has been virtually devoid of processual studies, although excavations by Pippin et al. (1979) resulted in a thoughtful model of the relation of human occupancy along the shore of Eagle Lake to local environmental contingencies. That the Eagle Lake research was performed in response to the cultural resource management needs of the Lassen National Forest is perhaps indicative of an encouraging trend in the region.

Research Questions

Current projects of importance in the Inyo-Mono subregion include the following:

High Altitude Archaeology in the White Mountains (Bettinger, UC Davis).

Regional Settlement Pattern Surveys in Deep Springs Valley (Delacorte, UC Davis).

Trans-Sierran Obsidian Exchange and Procurement (Hall, USFS; Basgall, Jackson, Bouey, UC Davis; Wilke, Bouscaren, UC Riverside).

Prehistoric Agriculture in Owens Valley (Wilke, UC Riverside; Bettinger, UC Davis).

Settlement Patterns in Long Valley/Mono Basin (Jackson, UC Davis).

Survey and Mapping of Obsidian Sources in the Inyo-Mono region (Wilke, Bouscaren, UC Riverside; Jackson, Bouey, Delacorte, UC Davis).

Ethnography and Photoarchival Research (Fowler, University of Nevada, Reno; Walter, Los Angeles County Museum).

Bettinger (1982) should be consulted for a discussion of problems of long term interest in the Inyo-Mono region. The more basic of these are as follows:

Regional Subsistence-settlement Patterns in Long Valley, Mono Basin, Coso/southern Owens Valley, Deep Springs, Fish Lake Valley, and Bridgeport Valley.

Trans-Sierran Obsidian Exchange and Procurement and its Relation to Subsistence-settlement Patterns in Long Valley in Particular and the Inyo-Mono Region in General.

Origins and Development of Food Production in Owens Valley.

Origin and Development of Complex Sociopolitical Organization in Owens Valley.

Volcanic Disturbance and Human Occupation in the Northern Inyo-Mono Region.

High Altitude Adaptation, its Origins and Nature.

Development of Numic Culture and Evidence for its Consequent Spread into the Great Basin.

There are few ongoing research projects in Surprise Valley and the Honey Lake Basin, owing, in part, to the remoteness of the region from centers of research, and in part to the pragmatic concerns of land management agencies. The latter, while they continue to provide the chief source of funding for local work, have suffered severe budgetary constraints in recent years. The most notable studies in progress include the following:

Reevaluation of Surprise Valley Faunal Sequences (S. James, University of Utah).

Obsidian Procurement Locales and Exchange Networks (Hughes, Sonoma State).

Site Location Determination (Johnston, Gates, USFS; Manuel, Bunten, BLM).

Ethnicity Patterning along the Paiute-Pit River Boundary (C. Raven, Great Basin Foundation; S. Raven, UC Davis).

Several longer-term research questions are available for future inquiry, identifiable chiefly on the basis of what has been learned so far of the data potential of the region. Among the more promising are the following:

Detection of the Paiute-Achomawi-Maidu Interface in Honey Lake Valley.

Strategic Implications for Great Basin Foragers of the Acorn Crop in Honey Lake Valley.

Timing and Mechanics of Numic Occupation.

Subsistence Strategies and the Role of Upland Exploitation in the Warner and Skedaddle Mountains.

Temporal and Spatial Patterning of Regional Rock Art Styles.

Consequences of Euroamerican Contact and the Archaeology of Assimilation.

Pluvial Lakes Adaptations (especially in Honey Lake Valley).

Ecological Determinants in Ethnic Stability and Boundary Maintenance.

Internal and External Regional Resource Exchange Networks.

Prehistoric and Early Historic Relations of Gidutikadu (Surprise Valley Paiute) and Wadatkut (Honey Lake Paiute).

Regional Planning

Articulation of State and Regional Plans

The California state plan for cultural resources management follows what may be termed a "Federal (sensu stricto) Model." Local plans are gradually integrated into the plans of ever-more encompassing regions, culminating in a comprehensive state plan. As a sample consequence of this process the plans for the Inyo-Mono and Surprise Valley-Honey Lake subregions are destined to be well-articulated with the state plan. It is of note that the individual heading the development of the Inyo-Mono portion of the state plan, R. Weaver, is the Inyo-National Forest Archaeologist. There is every reason to expect highly coherent linkages from the lowest level (regional agency plan) through the highest level (comprehensive state plan).

Predictive Models in Regional Planning

Because in relation to the rest of the Great Basin, the Inyo-Mono subregion is relatively well-studied, there is a substantial body of information to aid in the development of local resource management plans. One method by which this might be accomplished is by the use of predictive models, either those extant or those developed especially for this purpose. An example of the former would be the Unit Resource Assessments currently in use by the BLM; an example of the latter would be Bettinger's (1976) attempt to predict site densities and site types for Long Valley.

Those concerned with long-term regional resource planning in eastern California are clearly aware of these possibilities and equally aware of the pitfalls inherent in this approach. In general, broadly predictive models are likely to prove more appropriate than ones more narrowly

conceived. Thus, models that are addressed to the broad categories of archaeological manifestations present and the general distribution of those categories across the landscape will likely be of greater aid to regional planning than models that deal with more esoteric statistical parameters. Quantitative predictions in archaeology are still very crude, and useful primarily in relation to questions of theoretical importance (hypothesis testing and so on) rather than matters of practical application. In some areas of the Inyo-Mono region, of course, our ability to predict site density is quite acceptable, and in these cases such tools ought to be employed in the regional planning process. On the other hand, there can be no justification in attempting the same kinds of predictions for areas where the requisite data are wanting, simply because we would like to be able to do so.

The nascent California State Plan only recently has defined the boundaries of regions within which coordinated cultural resource management planning will be pursued. While subject to considerable logistical subdivision, the Northeastern Region (defined on cultural, natural, and administrative parameters) includes both Surprise Valley and the Honey Lake Basin. Until the State Plan progresses further through the RP-3 process, however, regional planning must continue to rely on the synthesis of individual agency plans.

In practice, since so much of the land base of the Northeastern Region is under federal jurisdiction, this means that plans developed by local offices of the USFS and BLM (and endorsed by their superior offices in San Francisco and Sacramento) will guide management policy toward the bulk of cultural resources in the area. Since both agencies are constrained by similar federal guidelines and since both are subject to SHPO review of their actions, relatively few discrepancies in legal compliance are observed. Active (as opposed to reactive) management, however, has not produced much interagency planning coordination save along contiguous jurisdictional boundaries. A large proposed interagency land exchange may serve to homogenize management philosophy in some parts of the region; conversely, it is likely to result in the dilution of some ongoing programs and the redirection of some historical management priorities.

The discussion above regarding the usefulness of predictive models in the Inyo-Mono subregion is applicable to Surprise Valley and the Honey Lake Basin as well, with an additional caveat: land managers (as well as some cultural resource managers) often ascribe to such models a reliability that far outreaches their intrinsic limitations. The hazard to the resource base, of course, is that areal predictions of "low sensitivity" may be translated into endorsements of carte blanche management flexibility. While this caution overstates any scenarios known to have been played out in northeastern California, one is inclined to note with trepidation that land managers less frequently challenge predictions of "low sensitivity" than they do those of "high sensitivity."

Communication with Native Americans

Native Americans are numerous and politically active in northeastern California, and most public agencies elicit their concerns in anticipation

of decisions that might compromise cultural values. The Lassen National Forest (which has been especially active in this regard), the Modoc National Forest, and the Susanville and Cedarville offices of the BLM all routinely seek Native American commentary on most major projects and land-use plans. In most instances, such agencies rely on informal or semiformalized contacts within the Indian community, with the understanding that few individuals are able or willing to speak for the group as a whole. Controversial issues, in fact, may be resolved (or their irresolvability identified) only through resort to public meetings of all interested parties. Especially important centers of local heritage concern include the Susanville Indian Rancheria and the Fort Bidwell Indian Reservation, although sufficient controversy may expand interest beyond the local sphere; members of the California Native American Heritage Commission (Sacramento) occasionally have joined directly in local debates.

Native American attitudes toward archaeology, whether in the interest of pure research or CRM, remain ambivalent. On the one hand, a large and sometimes vocal faction regards any disturbance of archaeological materials a compromise of tribal heritage; another group, perhaps equally large but less vocal, regards archaeological information as an important source of tribal heritage. This latter group reserves its opposition for such issues as the disturbance of burial grounds and sacred places. Since there have been relatively few excavations in recent years, there have been few opportunities for archaeologists to take advantage of the educational and public-relations benefits of employing Native Americans as monitors, consultants, and crew members.

Research Values

One must begin with the premise that CRM archaeology should be accountable to the same standards of quality and performance that govern the broader modern discipline of archaeology. Central to this is a basic sense of purpose or problem beyond that of mere fact gathering. A devotion to research questions of current interest and potentially lasting value is required.

The current tinge of disdain with which CRM archaeology is viewed in some quarters derives in no small part from frequent failures in this respect. The extent to which these failures are real rather than imagined is due in large part to structural differences between CRM archaeology and "pure research" archaeology. In the latter, the problem gives rise to and legitimizes the research project: there is no justification for research save in the presence of a question. In CRM archaeology, the project can easily exist in the absence of any important research problem or perceived gain in terms of new useful information. The surest sanctuary of the journeyman CRM archaeologist is that any information saved is better than all information lost, yet a moment's reflection shows how vacuous the notion is. Dull, unimaginative fact-gathering makes for poor archaeology irrespective of the context in which it occurs. In this respect the structure of the CRM process may provide the opportunity for but can never justify poor archaeology. The point is not merely philosophical. In an era of shrinking public funds, it would behoove the practitioners of CRM archaeology to continually sharpen their perception of problem orientation

and problem relevance lest the day come when, following the method used in distributing funds for pure research, CRM funding is extended only in instances where a strong case for research value can be made.

One means by which research questions might be made more central to CRM archaeology is to demand that every individual or group of individuals engaging in this kind of work have a demonstrated commitment to certain basic problems of research apart from those directly related to cultural resource management. Many of the best academic institutions engaging in CRM archaeology have a basic criterion that no project ought to be pursued unless it fits within a well-defined research program in which the institution is interested and has remained active. Were this also expected of private contracting firms it would certainly improve the quality and relevance of cultural resource management archaeology.

There are other elements at work here, however, not the least of which is that the degree to which problem orientation can be achieved is in part a function of the size of the project. The sense of problem is most easily achieved in large projects, where the area or number of sites in question virtually assures that a modicum of useful information will be obtained to address one or more particular issues. It remains only that CRM funding agencies insist on quality proposals that come to grips with such issues. This, in turn, demands that both those submitting proposals and those reviewing them be aware of the current state of the discipline of archaeology and the directions in which it is moving.

In small projects, on the other hand, the unit of space being sampled is often so restricted that it is difficult to be precise about what is expected, and the notion of guiding research design losses much of its meaning. It is often hard to derive research implications for pieces of space as small as a drill pad or units of culture as small as a ten-flake lithic scatter. Again, however, either we show the potential utility of archaeology in small places or risk the loss of public support for CRM archaeology in such contexts. As before, at the minimum we should expect that investigators be sufficiently attuned to the broader questions being debated in archaeology that, should information germane to these questions come to light, it will be seen for what it is. Moreover, it is perhaps not too much to ask that investigators who consistently undertake projects of such small scope themselves develop innovative research approaches that link small sites to large problems.

As in "pure archaeology" it will surely happen that from time to time a CRM project will yield disappointing results that resist every attempt to derive a clear, meaningful conclusion. yet at the very least in these cases an attempt should be made to sharpen the understanding of some problem that might have been addressed had circumstances been only slightly different. In short, while CRM projects may not always make a substantive contribution to archaeology or prehistory, they should be expected to make a contribution of some kind.

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Fig. 1. The Southeastern Oregon Subregion.

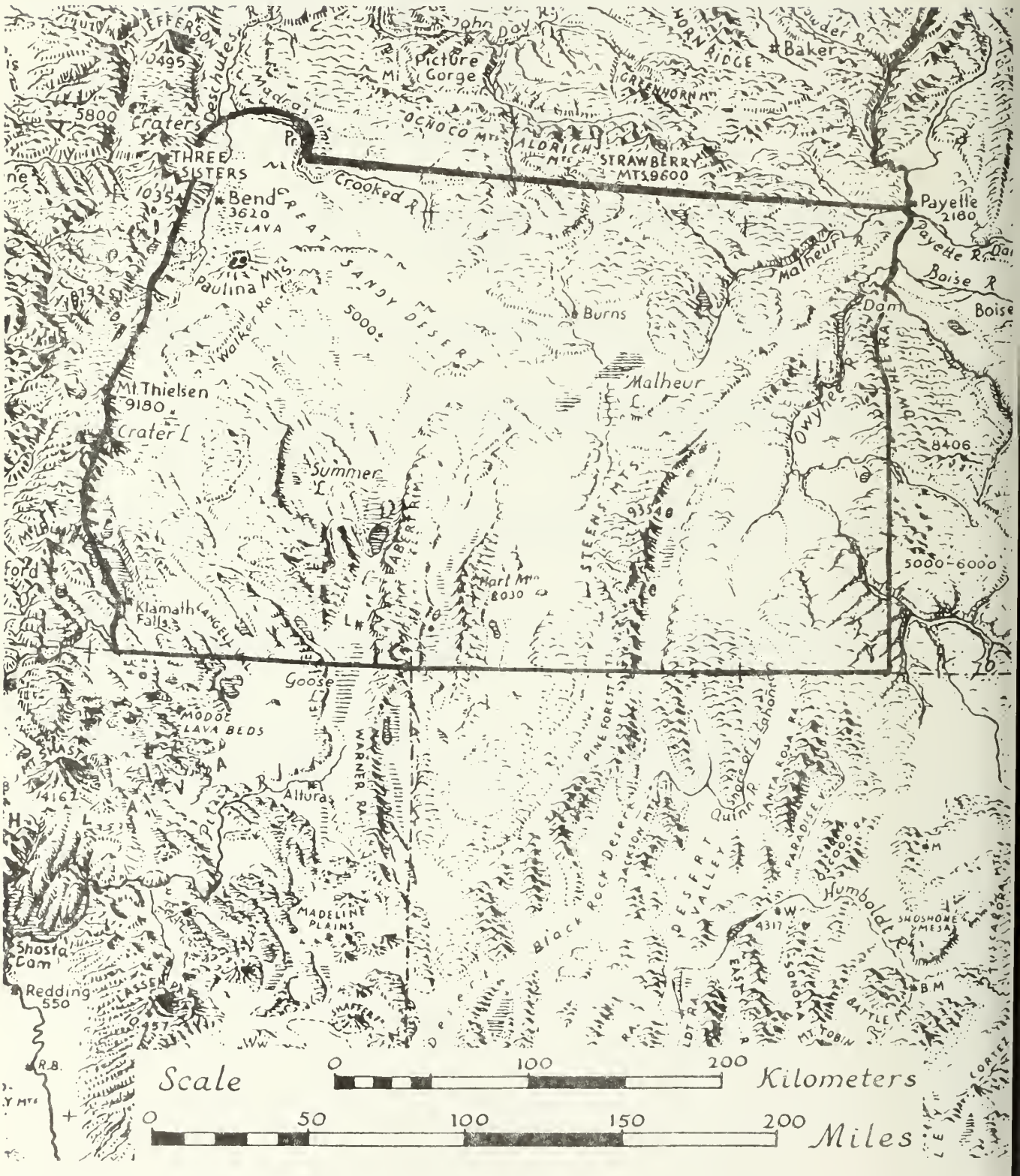

Fig. 1. The Southeastern Oregon Subregion.

SOUTHEASTERN OREGON

by

Leland Gilsen

Subregions

The Oregon portion of the Great Basin roughly coincides with six drainage basins set up for SHPO planning (State of Oregon's Water Resources Department hydrologic basin maps). These are the Owyhee, Malheur, Malheur Lake, Summer Lake, Deschutes and Klamath basins. These basins include portions of the Basin and Range, Owyhee Upland, High Lava Plain, and Blue Mountain Physiographic provinces.

Oregon contains three major river systems: (1) the Columbia system, (2) the coastal rivers, and (3) internal systems. Fifty-seven percent of Oregon drains into the Columbia River system. Twenty-four percent drains into Coastal rivers, and eighteen percent drains internally into the Basin and Range area. The Deschutes, Malheur and Owyhee drainage basins fall within the Columbia River system and drain through the Snake River. The Malheur Lake and Summer Lake drainage systems are the only internal drainage systems in Oregon. The Klamath basin drains to the coast through California

The Owyhee, Deschutes, Malheur, Malheur Lake, Klamath and Summer Lake basin systems incorporate portions of non-Basin and Range physiographic zones. The Oregon SHPO has defined them as research units for statewide planning. They are referred to as parts of the Great Basin study units in this report.

The state has been divided up into vegetational areas, which roughly correspond to the major physiographic zones. In simple terms, there are four major vegetational units: (1) forested regions; (2) interior valleys of western Oregon; (3) steppe regions; and (4) timberline/alpine regions (Franklin & Dyrness 1973:44). Most of the Oregon portion of the Great Basin falls within the steppe region.

The High Lava Plains is a high desert plateau in the south central portion of the state. It is characterized by small internal playa basins. The zone is dominated by Ponderosa pine and juniper communities mixed with sagebrush and grasslands. The Basin and Range zone resembles the High Lava Plains, but with more rugged terrain. It is also characterized by large playas. Ponderosa pine and juniper communities are mixed with extensive sagebrush and salt desert scrub communities. The Blue Mountains are to the northeast. Those sections of this zone that lie within the three Great Basin study units consist of mountains drained by river systems, with the slopes dominated by Ponderosa pine and Douglas-fir. The Owyhee Uplands is dry volcanic country cut by riverine canyons. Sagebrush and bunchgrass communities dominate but in some area, western juniper joins in a savannah community.

A high proportion of this area is Federal land owned by the Bureau of Land Management, and the Forest Service including the Winema, Deschutes, Ochoco, Malheur and Fremont National Forests. In addition, there are a number of major Fish and Wildlife Service refuges, including the Malheur and Hart Mountain refuges. These agencies have a variety of cultural resource management programs in operation at varied levels of compliance.

At the time of Euroamerican contact, the Northern Paiute occupied most of southeastern Oregon, including areas deep into the Deschutes and John Day basins to the north. The Modoc and Klamath occupied the western edge of the Basin and Range province in the higher elevations overlooking Summer Lake, Lake Abert and the Warner Lakes. There is evidence that the area around Lake Abert was exploited by Klamath/Modoc related groups as late as 2000 years ago (Pettigrew 1980:49-67, Pettigrew, Baxter and Connolly 1985, Pettigrew and Oetting 1985).

The archaeological record for southeastern Oregon indicates a long Archaic gathering and hunting continuum throughout the study unit basins. Recently, at the Dietz Site, a Clovis occupation is being explored (Fagan 1983). Nearby is Fort Rock Cave where a radiocarbon date of 13,200 BP from charcoal flecks in a stain believed to be a hearth was associated with a small number of artifacts. There is controversy over the validity of the date but this is the earliest hard evidence for human occupation in Oregon and probably the Great Basin (Aikens 1984). Other major sites include the Connley Caves (Bedwell 1973), Dirty Shame Rockshelter (Aikens, Cole, and Stuckenrath 1977), and Catlow and Roaring Springs caves (Cressman, Williams, and Krieger 1940; Cressman et al. 1942).

Recently, the Steens Mountain Prehistory Project surveyed 1400 square miles around Steens mountain (Aikens, Grayson, and Mehringer 1982). The results have not yet been published, but the project emphasized man/land relationships and environmental change. Survey was combined with excavation and lake sediment coring to establish paleoenvironmental parameters (Beck 1984; Jones 1984; Wilde 1985).

State Plan

A formal state plan has not been written since 1977. The early "planning" documents were statements of operations and policy. The SHPO is currently under directions to produce a State Plan. The current draft is a 29-page single spaced document designed to describe the functions and goals of the SHPO in Oregon. A draft of the plan has been forwarded to the major Federal agencies throughout the state, the Association of Oregon Archaeologists, the Historic Preservation League of Oregon, and other interested parties.

There has been no attempt to use RP-3 in Oregon to date. In 1979, the SHPO archaeologist attempted to start a cooperative planning venture for an archaeological plan. The attempt was aborted when vast areas of the state went without volunteer research.

The SHPO has divided the state up into drainage basins for the purpose of the statewide plan. These spatial divisions are the basic planning

units for analysis and synthesis of prehistoric data. Drainage basins are easy to categorize on maps and they are relatively long-lived units. Sites will always fall within the same unit over time. Culture change is a variable that must be addressed within this geographic format.

The current thinking on the Oregon preservation plan centers on the major drainage basins in Oregon. In addition, there is an emphasis on the development of a unified period nomenclature within which local phase names can be generated. The starting point will be early, middle and late paleo Indian and early, middle and late archaic. Early historic will be roughly equivalent to protohistoric and middle historic which correspond to exploratives. This system is easy to code into computers. Research will stress spatial and temporal variability with emphasis on paleoenvironmental reconstruction, human subsistence, and change (environmental and/or cultural). Lithic analysis and trace element sourcing are two major search topics.

Oregon lacks data synthesis and analysis for State Planning. There are a number of Federal (agency specific) overviews available for the Basin and Range area. These overviews include the Lakeview BLM, North-Central Oregon BLM, Deschutes, Winema and Malheur National Forest, among others (Minor, Beckham, and Toepel 1979; Goddard and Bryant 1979; Toepel, Willingham, and Minor 1980; Silvermoon and Kaiser n.d.; Mosgrove 1980).

Recently, the SHPO acquired an IBM-XT microcomputer. The site file data are being placed into this computer system and will be used for planning. The archaeological files and the bibliographic files will use dBASE III. Currently the bibliographic file is about 30% complete. Archaeological data entry has just begun with an experimental file from Baker county. Picking variables that are meaningful yet available from the forms and maps has been the major goal to date. If the computerization is to be meaningful for planning, then the variables chosen are of critical importance.

Problems also exist within the bibliographic files system. Many of the BLM surveys that were negative were not written up as reports nor sent to the SHPO. Instead, maps were sent yearly with areas surveyed drawn in color. These were added to the SHPO map file, but they do not exist in the SHPO bibliographic file. It is the bibliographics that are listed in the computer file. Each entry includes the project area and amount of area surveyed in acres. The BLM data are missing and will remain missing from the computer files.

The SHPO archaeologist has completed three draft chapters of a more extensive archaeological plan. This is being written in staff spare time and at the present rate of progress will take more than ten years to complete. This archaeological plan is modeled after the New Mexico plan published in 1981. It is based on the drainage basin approach broken down into paleo/archaic/historic phases. Only one basin has been studied and the archaeological data section has yet to be drafted. Given the time needed to write the plan, the early chapters will be out of date before the document can be printed.

Records

The statewide site records consist of two files: one on archaeology and one on buildings. They are located in the Salem State Parks Office at 525 Trade Street SE. In addition, copies of the archaeological forms are maintained by the Oregon State Museum of Anthropology (OSMA) at the University of Oregon in Eugene. Many forms are duplicated by the Universities and Community Colleges within the state, but the complete record is available only at the two locations noted. Some records are found at the federal agencies. A list of BLM, Forest Service and Fish and Wildlife contacts is in Table 1.

The historic building file consists of three ring binders filled with one-page structure forms. Each form has at least one photo of the site. These forms are given unique county numbers. A set of county and city maps codes these numbers to identify the sites. This material will be placed into an IBM-XT computer file. In addition, all structures on the National Register (NR) have a case file in SHPO central files. For years, buildings placed on the NR were not placed into the inventory so there are many gaps in the records. All NR sites have been coded onto the SHPO inventory maps by interns. The computer coding for the NR files has begun.

The archaeological (both historic and prehistoric) site file at the SHPO consists of the site forms, a complete set of USGS quad maps, and over 6500 reports. All sites are drawn onto the quad maps and assigned Smithsonian-style trinomial designations. All reported survey areas are color coded and drawn onto the maps. The reports are given numbers and placed into a research library. Each quarter, a bibliography of reports is published and sent to all CRM personnel in Oregon and the SHPOs of bordering states. This bibliographic file has been computerized since the last quarter of 1983. In addition, the files from 1978 to the last quarter of 1979 have been done. The three kinds of files (forms/maps/ reports) are tied together through the maps. The computer will create a new access method that will allow electronic sorting by any variable or combination of variables.

The archaeological site file will be computerized on the IBM-XT. The variables are still being discussed. Codes will be used wherever possible to save space. There are about 9,000 archaeological sites on file for the state as a whole. Computerizing will require over 400 weeks of full time work at 10 minutes a site. With only 25 variables per site this means coding 225,000 variables into the computer. Currently the system is a paper-file organized around the maps. It is possible to find data through the other sub-systems but the key is the USGS quad.

The SHPO files are open from 7:30 A.M. to 4:30 P.M. weekdays by appointment. The telephone number for archaeological data is (503) 378-5023 or 378-6508. They are open to qualified archaeologists and are protected by Federal and State laws under the Freedom of Information Act. A charge of $1 + $.05 per copy is made for copying. Due to lack of staff, consultants are expected to do their own research in the files or contact a local person for this purpose.

Table 1. Oregon Archaeologists in Federal Service (OAFS)

Bureau of Land Management

Oregon State Office
P.O. Box 2965
Portland, OR 97208
231-6953

Burns District Office
74 South Alvord Street
Burns, OR 97220
573-5241

Vale District Office
P.O. Box 700
Vale, OR 97918
473-3144

Lakeview District
P.O. Box 151
Lakeview, OR 97630
947-2177

Prineville District Office
P.O. Box 550
Prineville, OR 97754
447-4115

USDI Forest Service

Region 6 Archeologist
USDI Forest Service
P.O. Box 3623
Portland, OR 97208
221-3644

Deschutes National Forest
211 NE Revere
Bend, OR 97701
388-2715

Fremont National Forest
P.O. Box 551
Lakeview, OR 97215
947-2151

Malheur National Forest
139 N.E. Dayton Street
John Day, OR 97845
575-1731

Ochoco National Forest
P.O. Box 490
Prineville, OR 97754
447-6247

Winema National Forest
P.O. Box 1390
Klamath Falls, OR 97601
883-6801

Fish and Wildlife Service

Lloyd 500 Building, Suite 1552
500 NE Multnomah Street
Portland, OR 97232
231-6173

The content of each site record is variable. Site forms range from University of Oregon forms, through Forest Service and BLM forms, to a few out-of-state forms. Data vary and few forms are complete. Many lack key data categories that could be used for predictive modeling. Computerization will require extensive reconstruction of missing data categories. The estimated 10 minutes data entry time per site is probably a conservative figure when the need to reconstruct missing data is considered.

Table 2. Major Curatorial Facilities in Oregon

Facility:	Oregon State Museum of Anthropology
Location:	University of Oregon Eugene, OR 97403
Fee:	$100/cubic foot
Contact:	Don Dumond (503) 686-5102
Facility:	Anthropology Department
Location:	Oregon State University Corvallis, OR 97331
Fee:	$100/cubic foot
Contact:	Lee Lyman (503) 754-4515

Table 3. Minor Curatorial Facilities Located in the Great Basin Region of Oregon

BEND

Deschutes County Historical Society
129 N.W. Idaho St., 97701
Telephone: (503) 389-1813
Mail to: P.O. Box 5252
Founded in: 1975
Wanda V. Clark, President
Number of members: 400
Major programs: library, archives, manuscripts, museum, historic sites preservation, markers, tours/pilgrimages, newsletters/pamphlets
Period of collections: 1918-present

BURNS

Harney County Historical Society
18 West D Street, 97702
Telephone: (503) 573-2636
Mail to: Box 388
Founded in: 1950
Jessie Williams, Curator

Number of members: 125
Staff: full-time 1, volunteer 2
Magazine: Historical Highlights
Major programs: museum, tours/pilgrimages, books, newsletters/pamphlets, historic preservation
Period of collections: pre-1900

KLAMATH FALLS

Klamath County Museum
1451 Main Street, 97601
Telephone: (503) 882-2501, ext. 208
Founded in: 1953
Harry J. Drew, Director
Staff: full-time 8, part-time 1
Magazine: Klamath County Museum Research Papers
Major programs: library, archives, manuscripts, museum, historic sites preservation, oral history, educational programs, books
Period of collections: 1865-present

LAKEVIEW

Schminck Memorial Museum; Daughters of the American Revolution
128 S. E Street, 97630
Telephone: (503) 947-3134
Founded in: 1936
Charlotte Pendleton, Curator
Staff: full-time 1
Major programs: educational programs
Period of collections: 1840-1940

PRINEVILLE

Crook County Historical Society
A R Bowman Museum, 246 N. Main Street, 97754
Telephone: (503) 447-3715
Founded in: 1972
Irene H. Helms, Librarian and Attendant
Number of members: 1,000
Staff: full-time 2, part-time 1, volunteer 15
Major programs: library, museum, historic sites preservation, tours/pilgrimages, educational programs, newsletters/pamphlets
Period of collections: 1890-present

Survey Data

Most of the survey data for Oregon are generated by federal action. About 52% of Oregon is under federal ownership. In the Basin and Range area the percentage is higher. Forest Service and most other surveys in the past were reconaissance level, based on "high probability" areas mixed with a few 100% transect surveys. Many of the National Forests now use a

systematic sampling design written in consultation with the SHPO. These designs are simple, and based on a compromise between scientific need and economic necessity. Most of the BLM lands have received 100% systematic transect surveys of all project lands. These are the Class III inventories as described in BLM guidelines.

Very little survey is done on private or state land. Much of the riverine, spring and valley farmland is private throughout the state. The forests own much of the uplands of the Coast Range, Cascades and Blue Mountains. The BLM is the big land owner in the Basin and Range and High Lava Plains areas. In both cases, the prime land near water is in private hands. Surveys on Federal land thus tend to be biased towards "marginal" environments. This is a serious gap in survey coverage. When work is done on the prime lands, large stratified sites are found.

The Fort Rock Basin survey experimented with block samples on BLM lands and smaller samples within these blocks (Toepel, Minor and Willingham 1980). This resulted in a 10.35% sample of 94,560 acres. Sixty-six quarter section units were transected at 30 meter intervals. One hundred two sites were recorded. Since the actual surveyed area represented only 1.58% of the entire study area, no statistically valid statements were generated. Sites were found in all vegetative zones and a variety of topographic settings. Sites were concentrated near springs, lake margins and the floor of the old pleistocene lake below 4500 feet. Recently, Leslie Wildesen Associates experimented with a controversial model in the Prineville BLM area, based on soil formation. This model assumed that only sites with depth have research potential, and that only limited soil areas within the district have any depth. Therefore, it concluded that survey of less than 7% of the district is required, as soils with depth only occur on 7% of the district and any site on other soils cannot have depth and therefore can have no research value.

Recently the SHPO, in cooperation with the Bonneville Power Administration's Northwest Rivers Study, completed a plotting of site and survey densities for every township in Oregon. The entire data base was placed into the computer and run through a program for descriptive statistics. The arithmetic mean for all townships was 3.57 sites per township. The arithmetic mean for project size was 5.83% acres. The latter figure represents the percent of land coded onto our USGS quad sheets for the state. For any one project, the percent of survey coverage ranges from 100% to less than 1%. Using the 2389 reports in our bibliographic file as of September, 1985, the average percent of land surveyed is 27.1%. This reduces the 5.83% to a 1.58% inventory. If all factors were equal, these results would predict 229.6 sites per township or seven sites per square mile anywhere in Oregon. Since no environmental factors were controlled, this is a very speculative figure. It does give a general feeling for the entire data set for 2782 townships in Oregon.

Collection Policy

There is no formally structured state collection policy. Decisions are made at the local level or based on the specific project. Most agencies follow a no-collection rule during survey except where isolated

finds are concerned. Collections are made during the process of testing and/or intensive surface research.

The official repository in Oregon law for collections made on state lands is OSMA, which is also an officially designated federal repository. Collections are also maintained at other schools and museums. Copies of inventory data are maintained by OSMA and the collections at other locations within the state are also tracked by OSMA. In addition, under state law, OSMA approves the location for collections on all state permits issued by the Division of State Lands.

Environmental Data

The Forest Service and BLM maintain maps on soils, vegetation, hydrology and topography. Each BLM office maintains maps that show its land holdings. The state is characterized by a checkerboard pattern of federal land ownership due to early land laws. This has created many problems in management for the federal agencies and over the years they have been trading land to consolidate blocks where possible. Most of these data are stored in mainframe computers. the Oregon State Geologist maintains a research program in geology and soils mapping. The State Water Resources Department maintains a program of mapping hydrological systems. The respective agencies may be contacted for details.

Map coverage by the USGS in southeast Oregon is poor. The state is currently covered by a mixture of 15 minute and 7.5 minute quads, many of which are out of date. Large areas of central and southeast Oregon are not mapped on quads. The SHPO uses BLM 30-minute maps to cover these areas. Topographic maps are available from the State Geologist, the Water Resources Department, the Geological Survey and several Federal agency offices. The Map Library of the University of Oregon, Eugene, OR 97403, has excellent coverage of the state in both maps and air photos, which are available for examination Monday through Friday, 8:30 AM to 4:30 PM.

Paleoenvironment

Paleoenvironmental data are scattered throughout the archaeological literature. Most data are post-World War II and include lake pollen studies, glacial geology, soil pollen, vegetation sequences, faunal sequences, and ash sequences. Very early work by Cressman et al. (1942) and the recent work of the Steens Mountain project have attempted to create regional paleoenvironmental correlations. There are good data on ash horizons, with Mazama the primary index marker (Beck 1984; Jones 1984; Mehringer 1985; Mehringer and Wigand 1985; Verosub and Mehringer 1984; Wigand 1985; Wilde 1985). Most of the data are confined to the eastern half of the state with work focused on the Plateau or Basin. Bibliographic guides to the older literature are found in the various cultural resource overviews for the state, e.g., Minor, Beckham and Toepel (1980); Toepel, Willingham and Minor (1980); Thompson and Wilke (1979).

Generalized paleoenvironmental sequences are available, but little synthesis of the relatively scattered specific data has been done in recent

years. The SHPO has collected data from Environmental Impact Statements on environmental and ecological variables as well as books and reports on current ecological systems. The plan emphasizes collection of local paleoenvironmental data as the SHPO stresses individual basins.

Historic Archaeological Records

All archaeological records are considered to be a continuum, and the historic sites are given Smithsonian numbers in the general statewide site file. In general, only those sites older than 50 years and with archaeological potential are given numbers. All sites are in the SHPO bibliographic reports. Within the SHPO bibliographic computer file each report has a "index fossil" variable. This is a key word for site type: mine, cabin, trough, camp, townsite, etc. For example, all cabin sites can be sorted, or all mining sites on a district/ forest/quad. Sites with permanent numbers and sites with temporary numbers can be found under this system. The majority of the historic archaeological sites in the bibliographic files have not been given permanent numbers.

Other Photographic/Archival Records

The Oregon Historical Society, 1230 S.W. Park Ave., Portland, OR 97205, tends to be the primary repository for historic photographic and archival records. In addition, the Secretary of State maintains the Oregon Archives Division at 1005 Broadway N.E., Salem, OR 97310. The Oregon State Library maintains some archival and historic material in Salem. The SHPO maintains a photographic file on National Register properties as well as photos of the historic buildings in the Statewide Inventory. In addition, there is a slide file of buildings and archaeological sites in the SHPO. All universities in the state system maintain significant collections at their respective libraries. Among the most important collections are those at the University of Oregon, Oregon State University and Lewis and Clark College. The SHPO has a file of other libraries within the Northwest, many of which maintain some collections.

Summaries and Syntheses

The Forest Service and BLM districts have published a number of overviews of cultural resources. These range in quality and coverage. Most are basic reviews of the existing data base. Only a few offer synthesis or models of culture history and/or settlement patterns. They do, however, provide quite comprehensive bibliographic coverage. The SHPO maintains a bibliography of CRM reports and any other reports on Oregon prehistory, including some thesis and dissertations. The SHPO bibliographic files are characterized by large numbers of survey reports. There are some testing reports and a few overviews. Settlement pattern models, chronological studies, and research reports are rare (see References).

There is little theoretical research within the federal CRM reports being generated in archaeological survey and excavation. Existing models stress cultural ecology with both environmental models and population growth models the most common. Many reports include ethnographic and

environmental data but there is little attempt to use this information in interpretation. The majority of the CRM-generated survey and testing reports contain poorly documented descriptive data. Seldom is there any attempt to synthesize the survey information from previous projects and extrapolate subsistence/settlement patterns. Even where important new data are generated that could refine chronology and culture history, there is seldom an attempt at synthesis.

C. M. Aikens has published a series of syntheses on the Northern Great Basin. These include an article in the Annual Review of Anthropology (1978), an overview in Man and Environment in the Great Basin (1982) and a book, Archaeology of Oregon (1984).

Research Priorities

Since there is no CRM regional research design for the Oregon portion of the Great Basin, the dominant research questions have been those generated by academic projects. Most CRM generated survey and testing has been done at a minimum level to meet federal legal mandates. An experimental Lithic Scatter Memorandum of Agreement extends to the Forest Service lands marginal to the Basin. This MOA stresses human adaptation and environmental variables. Future data recovery plans within these areas will stress the gathering of data on man/land relationships, reconstruction of paleo-environments, site function, chronology, and culture history. Aikens (1984) suggests that data must be gathered about the size and organization of groups, their settlement patterns, their relative degree of sedentism, local variation in adaptation, environmental change, and other historical factors.

Given the stability of the geomorphic environment in Southeastern Oregon, sites covering thousands of years of prehistory are found dotting the surface. Most of these sites have not been adequately dated. As new radiocarbon data come in, projectile point forms are seen to cover broader areas of time, making their use as index markers for dating occupations less useful. This limited ability to date sites, as pointed out by Lyneis and Macko (this volume), hampers research in the Northern Great Basin as well.

The recent multi-university Steens Mountain Prehistory Project referred to above offers some help in reconstructing paleo-environmental change. The stress laid on paleoenvironmental variables in the Lithic Scatter MOA should insure site specific data over the long run in the forested areas of the Great Basin periphery. This orientation needs to be expanded to BLM-related data recovery plans.

There are gaps in the data base. Most site survey in the state is concentrated on federal lands in response to project-specific legal requirements. Survey data on forested areas between small upland drainage systems are increasing. In the forest areas, there are gaps in the data from the main river valley systems where there is a preponderance of private ownership. In BLM-owned areas there is a loss of data again in prime habitat areas under private ownership. The federal emphasis on avoidance of sites without testing has created a large data base of poorly

documented sites. Most of the site data lack basic chronological controls. Many of the site forms are poorly documented, with too much vital data missing. Since many of the sites will never be visited again, this data base must be stressed as a critical concern for research.

There are insufficient numbers of excavated sites within the sub-drainage basins for the development of local chronological and phase systems. The spotty project specific data base is not useful for statistically valid predictive modeling. Project specific research designs are generally simple survey models stressing high probability zones extrapolated from existing data. These models are self feeding and therefore not reliable. The research excavation designs tend to be minimal data recovery designs for simple descriptive reports. Only recently have the forests begun using systematic survey designs that will be tested against results for restructuring.

Predictive Modeling

Data base problems that are also relevant to predictive modeling efforts have already been addressed. In addition to these problems there is the lack of a good system for chronological control. As indicated, most sites can only be dated from index fossil point typologies. There is no plastic medium such as ceramics to help refine chronological controls. Given the problems associated with chronology, data from paleoenvironmental studies cannot often be fully integrated with the archaeological data. The one good environmental/chronological control in the state is in the study of ash falls from volcanic eruptions (Kittleman 1973; Mehringer 1985).

A number of researchers have commented on the sloppiness of the data in the SHPO site files, which has made modeling difficult. The computerization of the site files will increase data input as some missing information will be supplied during data entry. Development of a standard form stressing geoarchaeological data will alleviate some of this problem for data to be gathered in the future.

The recent development of artificial intelligence "expert system" software contains some hopeful possibilities for establishing local and regional research contexts. These programs "learn" to recognize rules and patterns in decision making and to generate flow diagrams and relative weights. We all review data and make decisions about sites all the time. These software packages will ask questions and create attributes and weigh their importance. They then strip away the non-essential and create the most efficient systems to resolve an issue. This may sound trivial, but it does create clear decision trees and encourages orderly thought processes. These programs articulate "gut feelings" into a form the program can use. When confronted with insufficient data, the system asks more questions, draws more tenuous conclusions and hedges its bets with tentative terms.

Since we are in the mode of "ask four archeologists" and "get four designs" as pointed out by Lyneis and Macko (this volume) in their discussion of the Mojave region, having all the "experts" run through an "expert system" package should generate a list of key attributes for evaluating archaeological sites. Given the nature of the problem, it is

worth a try. Case-by-case evaluations can be merged into a regional model. Since there is no mechanism for regional establishment of planning/evaluation contexts, this may be a way out.

Data Losses

There is a steady surface collection and site-potting attack on the data base in Oregon. Surface collecting and potting cave sites are very popular hobbies in central and eastern Oregon. Most surface sites have been collected to destruction by small scale repetitive collecting of diagnostic tools. It is rare to find a cave or shelter that has not been extensively and/or intensively dug. The constant small scale actions of hundreds of collectors are destroying the existing data base. Sites recorded one week are stripped of all diagnostic artifacts a few weeks later. Examples of this abound.

In addition to such intentional hobbyist destruction, data from forest surveys indicate that large numbers of sites are being impacted by the private timber industry. The SHPO reports are recording about 50 new sites a month even under the current timber slowdown. Several thousand sites each year must be impacted by the intensive forest cultivation that occurs on private forest lands. Data from other Federal projects suggest that hundreds of sites are destroyed each year in private construction activities.

Regional Planning Potential

There has been no attempt to create regional planning designs across state boundaries. The lack of systematic planning below and within the state levels makes such efforts difficult at best. Regional research questions do exist in the archaeological literature. Oregon has a Land Conservation and Development Commission which is responsible for land use planning. There has been some attempt to get National Register properties into the plans, and some counties and local governments have archaeological data. There is no mechanism, however, for updating the data the planners have obtained. The SHPO helps pay for county and city building surveys. There is no formal State Archaeologist in Oregon, and therefore no systematic statewide archaeological survey of non-Federal lands. The relative expense of archaeological survey has kept it out of land-use planning.

The only regional planning in archaeology in the State of Oregon has been the development of Forest Service research designs for surveys and the Lithic Scatter MOA. The former cover a specific forest and the latter covers forests east of the Cascades. The SHPOs with common borders cooperate on file data, and researchers from the surrounding states use the Oregon site files for projects that cross state boundaries. The SHPO sends copies of the bibliographies to states with common borders.

Given the lack of regional planning to date there is nowhere to go but up. There are problems with staff time for planning at the state level. The Oregon SHPO has a staff of four and one office manager. Each staff person is responsible for a major program area. The program areas are:

(1) National Register, (2) Review and Compliance, (3) Federal Grants and Tax Act, and (4) State Tax and Site Files. Planning is a full time program area with no staffing possible under current restraints.

Communication with Native Americans

There is organized communication with Native Americans under state laws and through contact with tribal groups. All Indian burials must be dealt with through contact with the relevant tribal groups. Excavations on any non-federally owned Indian site (prehistoric or historic) must be coordinated with the tribes and copies of reports submitted to the tribes concerned.

Native Americans have not been notified during routine A-95 and Section 106 reviews. Given the time constraints in the review process, the SHPO staff has difficulty addressing this problem. Most reports are reviewed within 10 working days. At times, review catches up with the workload and the reports are completed as they come in each day. At the current time the Oregon SHPO is reviewing about 8 projects each day (1 hour per project). This is down from about 15 minutes a project before the recession and the loss of timber industry within the state.

Under state law, Native American groups are immediately consulted when burials are encountered. The appropriate Indian tribe or group whose traditional area includes the burial in question is contacted, and the remains and burial goods are reinterred as the group directs (Gorospe 1985).

A recent conference on Indian Cultural Resources held at the University of Oregon (May 1986) which attracted many Native Americans and archaeologists, was highly successful in furthering communication between the two groups and focusing attention on the importance of further fostering mutually beneficial interactions.

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Fig. 1. The Southern Idaho Subregion.

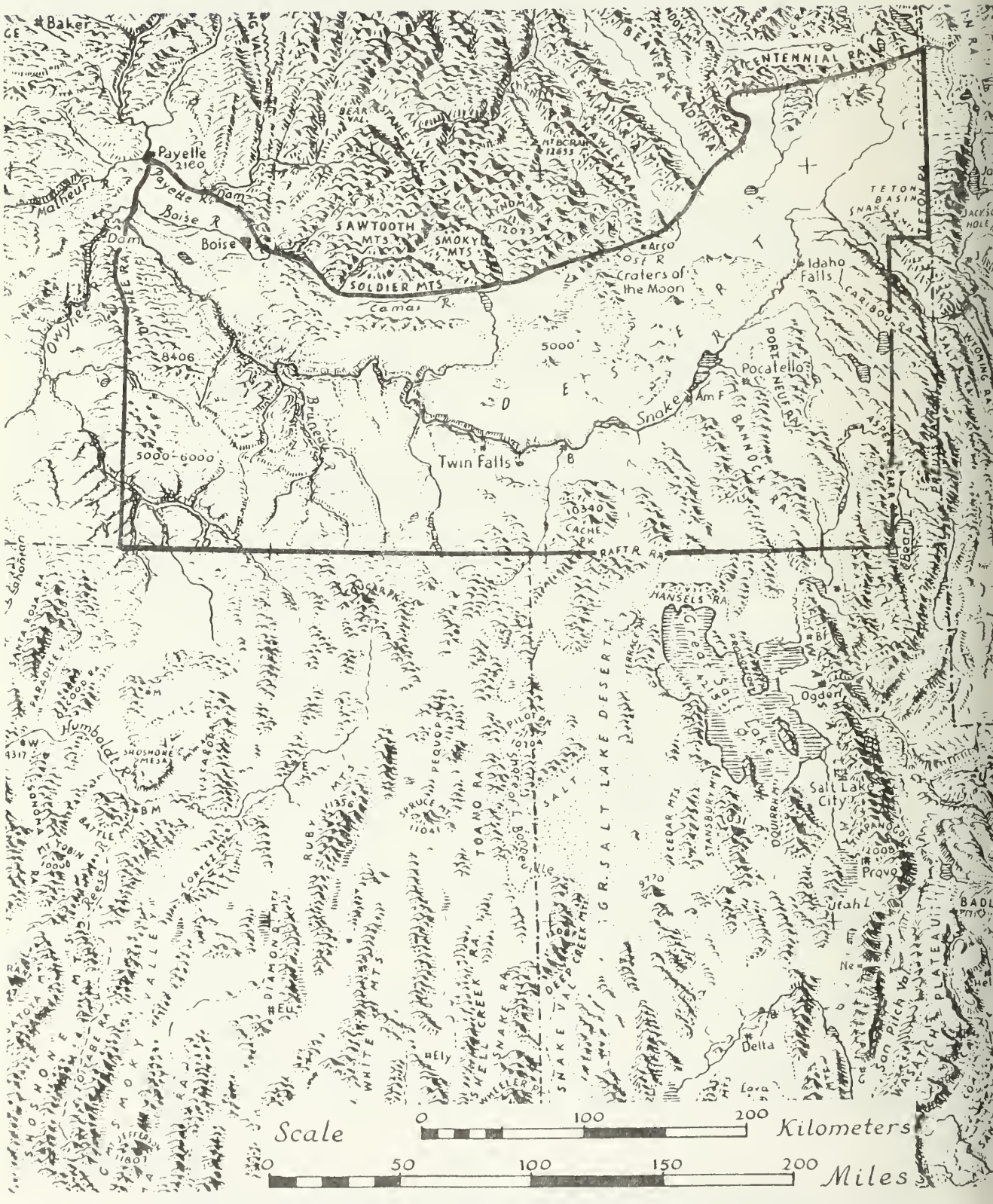

Fig. 1. The southern Idaho Subregion of the Great Basin.

SOUTHERN IDAHO

by

Thomas J. Green

Subregions

This report covers Idaho south of the Northern Rocky Mountains. It includes the Snake River Plain and the areas south of the Snake River Plain to the Utah and Nevada borders (Fig. 1).

The earliest inhabitants of southern Idaho were representatives of the big game hunting Paleo-Indian traditions common to other parts of North America. Clovis, Folsom, and Plano projectile points characteristic of this tradition have been found all across the Snake River Plain in southern Idaho. Around 8,000 years ago Archaic hunters and gatherers began adapting to the varied environmental settings of southern Idaho. Little information exists on the early periods of this tradition, but in eastern Idaho the Early Archaic peoples apparently continued a hunting tradition focused on bison and bighorn sheep. By 4,500 years ago Archaic peoples were building large pit houses along the Snake River. Northern Side-notched, Humboldt, and Elko series projectile points were common. A broad spectrum hunting and gathering economy was established by this time. Dating around 1200 to 1300 years ago, Rosegate projectile points are found in association with fairly substantial pithouses. It appears that population levels were higher between 1200 and 800 B.P. than in earlier or later time periods. There is also evidence of influences from Fremont peoples during this time period. Desert Side-notched and Cottonwood Triangular projectile points, and Shoshone type pottery, become common after 800 BP. House structures appear to be much smaller and not as well made during this time period. The early European explorers found Shoshone and Northern Paiute peoples living in southern Idaho during the early 1800s. The Northern Shoshone and their Bannock compatriots were a fully adjusted equestrian society while the Western Shoshone and Northern Paiute followed a more conservative lifestlye.

Southern Idaho can be divided into five sub-regions based on the physiographic zones defined by Fenneman (1931) and Freeman, Forrester, and Lupher (1945). On the extreme eastern edge of the state along the Idaho-Wyoming border is the Middle Rocky Mountain Province. This includes the Yellowstone Plateau in the north, the Tetons, and the Aspen, Caribou and Bear River Mountains in the southeast corner of the state. A portion of the Basin and Range Province extends into southeastern Idaho. The region is characterized by parallel block faulted mountains separated by broad open valleys. Portions of this physiographic region are drained by the Snake River system and portions drain into the Lake Bonneville basin.

The remainder of southern Idaho is part of the Columbia Intermountain Province, and it is all drained by the Snake River and its tributaries. There are three subdivisions of the province in southern Idaho. The Eastern Snake River Plain is a flat lava filled basin broken by large

volcanic buttes. The region includes the Pioneer Basin where the Big Lost River, Little Lost river, and Birch Creek drain. The western Snake River Plain is included in the Malheur, Boise and King Hill subdivision. This unit is characterized by relatively flat topography at elevations between 2500 and 3500 feet ASL. Compared to other areas in southern Idaho this area has a very mild climate. The Snake River is deeply incised except on the Oregon/Idaho border. The Boise, Payette, Weiser, Owyhee, and Malheur rivers all empty into the Snake River along the Idaho-Oregon border.

The Owyhee Uplands section includes the Owyhee Plateau and the Owyhee Mountains in southwestern Idaho. The Owyhee Plateau is a high rolling upland 4,000 to 5,000 feet ASL deeply incised by the Owyhee, Jarbidge, and Bruneau Rivers. The Owyhee Mountains separate the Owyhee Plateau from the Western Snake River Plain. These mountains average between 6,000 and 8,000 feet high.

The preceding geographic units are recorded on site forms used by the Intermountain Antiquities Computer System (IMACS), of which Idaho is a part (see Lichty, this volume). These units are subdivided on the basis of drainage basins, and the drainage basins are further subdivided to separate the valley bottoms from the surrounding mountains. This was done to meet the needs of the BLM and the USFS. Thus there are a series of small subdivisions that can be combined to meet most research or management needs.

State Plans

The comprehensive planning system adopted by the State of Idaho follows the Secretary of Interior's standards for preservation planning (Federal Register Vol. 48, No. 190, pp. 44716-44720). The process begins by defining geographic or thematic study units. Historic contexts are developed for each unit that provide an overview of the prehistory or history of the unit, identify deficiencies in the data base, and suggest ways to eliminate these deficiencies. Factors affecting the resource base are identified through consultation with state, federal and tribal planning agencies and professional and amateur organizations. Goals and priorities for survey, nomination, and preservation are identified, and this information is then shared with planning agencies for their use.

A number of historic contexts have so far been prepared for southern Idaho. These include archaeological overviews by Butler (1978), Plew (1980a), Franzen (1981), and Gehr (1982), and historical overviews which are on file with the Idaho SHPO. The preparation of actual management plans for study units has not yet occurred. A plan does exist for the placement of archaeological National Register districts along the Snake River in southern Idaho (Green 1981, 1983). This plan, which encompasses a number of study units, is currently being implemented.

Site Records

Location

In 1976 three archaeological centers were established in Idaho. The Southeastern Idaho Regional Archaeological Center is located at the Idaho State University Museum of Natural History, Idaho State University Pocatello, ID 83209. The Northern Idaho Regional Archaeological Center is located at the Laboratory of Anthropology, University of Idaho, Moscow, ID 83843. The Southwestern Regional Archaeological Center is located at the Idaho State Historical Society, 610 N. Julia Davis Drive, Boise, ID 83702, and is operated in cooperation with Boise State University.

In conjunction with the Idaho SHPO, each center is responsible for the maintenance of site records and the assignment of Smithsonian numbers to archaeological sites in its region. In addition, these centers offer permanent storage for the preservation of all archaeological collections and records from sites in their respective centers. Also, each BLM Office and National Forest has a complete set of site records for its area.

All three regional archaeological centers maintain collections and records from excavations of historic sites in their respective regions. However, the Laboratory of Anthropology at the University of Idaho is the main center for historic archaeology in the state. The Laboratory maintains type collections of artifacts from Idaho and Northwest historic sites. Of special merit is the type collection of Chinese artifacts representative of materials found in Chinese sites in western North America. In addition, the Laboratory maintains a metals cleaning and restoration facility. The Idaho State Historical Museum is currently organizing its collections so that they can be used for study and reference by historical archaeologists.

The Idaho State Archaeologists' Office (Idaho State Historical Society, 610 Julia Davis Drive, Boise, ID 83702) maintains a complete set of archaeological site records for Idaho. Also, 7.5 minute and 15 minute maps showing the locations of sites in southern Idaho are maintained in this office. In addition, 1:100,000 maps showing the locations of all surveys in southern Idaho are kept and updated by the State Archaeologist. The Idaho SHPO maintains the inventory of historic sites in the state.

Organization and Accessibility

In 1982 the Idaho Advisory Council of Professional Archaeologists adopted the Intermountain Antiquities Computer System for use in southern Idaho. IMACS site forms are the official site forms for use in this part of the state. The Idaho SHPO, Region IV U.S. Forest Service, and the Idaho Bureau of Land Management are currently in the process of transferring all archaeological site data into IMACS encoding forms for computerization. By the summer of 1986 all archaeological site data for southern Idaho should be part of the IMACS system.

Repositories and Collections

Four centers curate materials from CRM investigations in Idaho.

Facility:	Idaho Historical Museum
Location:	Boise, Idaho
Accepts CRM Collections:	SW Idaho only
Curation Fee:	None (a fee charged for processing)
Written Policy:	Yes
Contact:	Thomas J. Green, State Archaeologist (208-334-3847)

Facility:	Idaho Museum of Natural History
Location:	Idaho State University, Pocatello
Accepts CRM Collections:	SE Idaho only
Curation Fee:	None (a fee charged for processing)
Written Policy:	Yes
Contact:	B. Robert Butler, Curator (208-236-3717)

Facility:	Laboratory of Anthropology
Location:	University of Idaho
Accepts CRM Collections:	North Idaho only
Curation Fee:	None (a fee charged for processing)
Written Policy:	Yes
Contact:	Roderick Sprague, Director (208-885-6123)

Facility:	Boise State University
Location:	Boise, Idaho
Accepts CRM Collections:	No
Curation Fee:	None
Written Policy:	No
Contact:	Max Pavesic, Professor (208-385-3406)

Some important collections from the state are curated outside of Idaho: The Heye Foundation in New York has archaeological collections from southern Idaho. These include portions of the Shellbach Cave materials excavated in 1929 (Shellbach 1967) and materials from the Bruneau River. The faunal material from Jaguar Cave (Sadek-Koros 1966) is located at the Museum of Comparative Anatomy, Harvard University.

Archival and Photographic Collections

A number of libraries maintain reference collections on Idaho history that are of interest to historic archaeologists. The Idaho State Historical Society operates the State Historical Library and the State Archives. The libraries at Idaho State University, Boise State University, and the University of Idaho all have strong reference collections as well as some manuscript materials. Other reference materials and manuscripts exist at the University of Utah, the University of Nevada-Reno, the Bancroft Library, University of California, Berkeley, and the Oregon

Historical Society. The National Archives and the Federal Record Center in Seattle should also be consulted. The Laboratory of Anthropology, University of Idaho, maintains the Pacific Northwest Anthropological Archives which contain references to both historic and prehistoric sites. The Idaho State Historical Society is currently engaged in preparing a guide to the collections of Idaho historical reference materials.

The Idaho State Historical Library has one of the larger collections of photographs pertaining to Idaho history. The libraries at the major universities in the state also have collections. The Denver Public Library and the U.S. Geological Survey in Denver have extensive collections of photographs of the western United States. Historic photographs of Idaho's Indian peoples can be found in the following repositories: Anthropological Archives, Smithsonian Institution; Idaho State Museum of Natural History, Idaho State University; Bannock County Historical Society, Pocatello; Fort Hall Indian Reservation; Duck Valley Indian Reservation; Center for the American West, Sun Valley; Idaho State Historical Library; University of Nevada-Reno; and the University of Idaho. City and county historical societies in Idaho also have collections.

Survey Data

Nature of Coverage

Reconnaissance, intensive and sample surveys have been conducted in southern Idaho. Sample surveys have been sponsored by the BLM in all the southern Idaho district offices (Cinadr 1976; Franzen 1980; Kingsbury 1977; Roberts 1976; Tucker 1976). These surveys were conducted by the BLM during the mid-1970s to provide information on the density and distribution of archaeological sites for planning purposes and to satisfy EO 11593 requirements. Sample surveys have also been sponsored by the Idaho SHPO in Owyhee County, southwestern Idaho, for planning purposes (Moe 1982). None of these surveys have been used to develop predictive models. Intensive surveys, that is surveys where the intent is to find all archaeological sites in a given area, are characteristic of almost all government sponsored compliance work.

Massive amounts of survey data have been collected by the USFS and BLM since the mid-1970s (for references see Pavesic, Plew and Sprague 1979, 1981; Wylie and Flynn 1977; Wylie 1978; Wylie and Ketchum 1979, 1980; Gallagher 1981, 1983). In addition to these agencies, the Corps of Engineers, Bureau of Reclamation, the Federal Energy Regulatory Commission, and the Federal Highway Administration (see Gaston 1981, 1982, 1983) have funded surveys and excavations. Reconnaissance surveys are rarely conducted in Idaho today and by their nature are difficult to keep records on.

It is difficult to estimate the total numbers of acres or square miles that have been surveyed. Also, even if this were possible, the completed surveys are not comparable because of their uneven quality. Approximately 7000 sites have been located in southern Idaho.

Gaps in Coverage

The biggest gap in archaeological survey data is from private land. Extensive surveys on private land have occurred only when a Federal project, such as a dam or power line, is planned on such land. The Idaho SHPO has funded a number of surveys in areas with extensive private land holdings, but compared to the amount of area surveyed on Federal land it is a small contribution. This is a significant problem. The private land in southern Idaho is the best watered, has the best soils, has the most varied vegetation, and in general has the largest and most complex archaeological sites.

Sample Surveys

Such surveys have been used solely for planning purposes in southern Idaho. The BLM conducted a number of these types of surveys in the late 1970s to help predict the general effects of grazing on archaeological sites. So far, predictive models have not been generated using sample survey results.

Environmental Data

Spatial Data

There is a great deal of information concerning the existing environment of southern Idaho, and most of it has not been tapped by archaeologists. In addition to the standard academic sources of information, the BLM and Forest Service have been required to prepare land use plans and environmental statements that cover broad areas of southern Idaho. These documents contain a great deal of original information on the environment, as well as references to other environmental work in the area. Also, these documents provide detailed maps of soils, vegetation, and water. Both agencies have reports listing the availability of these documents.

Maps and aerial photo coverage: Aerial photographs and USGS 15 minute and 7.5 minute maps are available for all portions of southern Idaho. Information on the aerial photo coverage can be obtained from the Soil Conservation Service, the BLM and the Forest Service. The aerial photography is not all of equal value.

Geology/Geomorphology: Because of the importance of mining to Idaho's economy, research concerning the structural geology of the state has been paramount. Late Pleistocene and Holocene geomorphological studies are less common. Two recent publications, Cenozoic Geology of Idaho (Bonnichsen and Breckenridge 1982) and Late Quaternary Environments of the United States (Wright 1983), summarize much of what is known about the Quaternary in Idaho. The Idaho State Library has produced two bibliographies of USGS reports about Idaho. One is entitled "USGS Professional Papers Pertaining to Idaho" (1978a) and the other is called "USGS Bulletins Pertaining to Idaho" (1978b). Additional references can be found in "Graduate Theses on the Geology of Idaho, 1900-1977" by Gaston (1979). Information on the Late Pleistocene glaciation of central and southern Idaho can be found in Dort (1965); Evenson, Cotter, and Clinch (1982); Knoll (1977); McDonald (1954); Schmidt and Mackin (1970); and Williams (1961).

Hydrology and Climate: The North Pacific Region Comprehensive Framework Study published by the Pacific Northwest River Basins Commission (1970) contains detailed information on the hydrology and climate of the Columbia River drainage in Washington, Oregon, Idaho, Montana and Nevada and the Great Basin of Oregon. Appendix V (2 vols) of this report, entitled "Water Resources," contains information on precipitation, temperature, wind, evaporation, humidity, river discharge records, river profiles, and aquifers. Appendix IV, entitled "Land and Mineral Resources," contains information on land ownership, soils, land use, and mineral and metal resources. The Idaho Department of Water Resources publishes descriptions of various watersheds in its "Water Information Bulletins." Published by the Meteorology Committee of the Pacific Northwest River Basins Commission is the "Climatological handbook of Columbia Basin States." The report is in three volumes and contains station by station information on temperature (Vol. I, 1968), precipitation (Vol. II, 1969), and hourly data (Vol. III, 1969). Also, the U.S. Weather Bureau publishes monthly bulletins of the climatological data from Idaho.

Soils: The Soil Conservation Service has detailed soil maps for most of the farmed agricultural land in southern Idaho. Soil maps of lands managed by the BLM and the USFS are currently being prepared. The Soil Conservation Service has up to date information on the coverage in various regions.

Vegetation: The basic reference on Idaho plants is Davis (1952). Torgeson (1982) has compiled a list of plants occurring in Idaho that are referenced in Great Basin ethnobotanical studies. Additionally, the Idaho Fish and Game Department has digitized line maps indicating vegetation habitat classes for each county in southern Idaho. The maps come with a list of the habitat classes with descriptions of the plant associations included. Other important references on plant geography include Daubenmire (1962), and Cronquist et al. (1972).

Animals: Basic references on the contemporary animals of Idaho are "Mammals of Idaho" (Larrison and Johnson 1981) and "Fishes of Idaho" (Simpson and Wallace 1978). These two general sources have references to particular species as well as to general ecological studies. A dated but useful publication is "A Partial Bibliography of Idaho Wildlife" by Dalke (1973). The Idaho Department of Fish and Game has publications on all the major game animals in the state. In addition, the Fish and Game Department maintains a library which attempts to obtain all publications on Idaho wildlife. Buried in many publications on game management are detailed discussions of the distribution and density of plants used as browse by big and small game. This information provides essential data to estimate cost ratios for those interested in optimal foraging theory or similar optimization concepts.

Paleoenvironmental Data

There are a number of studies of Late Pleistocene and Holocene environmental change in southern Idaho. The majority of these studies rely on data gathered in central and eastern Idaho. Few studies of environmental change in western Idaho have been initiated. The basic references

are Bright and Davis (1982); Butler (1972, 1976, 1978); Davis (1982, 1984); Davis and Bright (1983); Gruhn (1961); Henry (1984); Swanson (1972); Swanson and Muto (1975); and White et al. (1984). Wilson Butte Cave (Gruhn 1961) provided the initial climatic sequence based on changes observed in the sediments and faunal materials found in the cave. This was augmented by Swanson's analysis of rockshelter sediments in the Birch Creek Valley (Swanson 1972; Swanson and Muto 1975). Butler's (1972, 1976, 1978) contribution was based on his work at the Wasden Site and a reanalysis of the Wilson Butte Cave and Birch Creek sequences. Recent work in southeastern Idaho has focused on obtaining new pollen sequences to augment the Swan Lake (Bright 1966) and Lost Trail Pass (Mehringer et al. 1977) records, and to locate pack rat middens and micro-fossils (Bright and Davis 1982; Davis 1982, 1984; Davis and Bright 1983). In southwestern Idaho, excavations at Murphey's Rockshelter (Henry 1984) obtained a record of small mammals and pollen that allows a characterization of the climate over the last 10,000 years. This is the first such study in southwest Idaho. Grayson's (1977) work at Dirty Shame Rockshelter should also be mentioned. Technically, the rockshelter is in Oregon, but it is almost on the Idaho/Oregon border. Grayson's (1975) bibliography on North American climate is also useful.

Summaries and Syntheses

Researchers interested in Idaho archaeology should first consult the published bibliographies of Idaho archaeology (Pavesic, Plew, and Sprague 1979, 1981), and the Pacific Northwest Anthropological Archives, Laboratory of Anthropology, University of Idaho.

General works about Idaho prehistory are Butler's "Guides" (Butler 1968, 1978), and Plew's (1979a) "Archaeology in Southern Idaho." The State Office of the Idaho BLM recently published two overviews. One covers southeastern Idaho (Franzen 1981) and the other southwestern Idaho (Gehr et al. 1982). A recent compilation of radiocarbon dates from Idaho is an important reference tool (Plew and Pavesic 1982).

A number of research publications must be noted because they synthesize pertinent information and make general statements about Idaho prehistory, or because they make significant contributions to our knowledge of western North America. The most significant research in Idaho in the past few years is the investigation of the Wasden Site on the eastern Snake River Plain (Butler 1978; Dort and Miller 1977; Miller and Dort 1978; Miller 1982). The site is not only old but also has a long record of occupation. Gruhn's (1961) monograph on Wilson Butte Cave is still one of the best reports on any site in Idaho. Swanson's (1972) work in Birch Creek Valley establishes the cultural-historical framework with which archaeologists in eastern Idaho still have to deal.

Publications dealing with southcentral Idaho include J. P. Green's (1972) report on research at Rock Creek; the research associated with the construction of the Hagerman National Fish Hatchery (Pavesic and Meatte 1980; Lothson and Virga 1981; Landis and Lothson 1983); the investigations associated with the Wiley and Dike Dam project (Plew 1981); and the Kanaka Rapids excavations (Butler and Murphey 1983).

Research in southwestern Idaho contributing to a regional perspective is the work at the Lydle Gulch Site (Sappington 1981a); the Dry Creek Cave excavations (Webster 1978); and the recent research in the Payette River drainage (Ames 1982; Artz 1983; Plew, Ames and Fuhrman 1984). The research in the Payette drainage and Plew's (1980a) research in southcentral Owyhee County are the only attempts to describe areal settlement patterns in a particular region in southern Idaho. A recent volume of the "Idaho Archaeologist" was devoted to summarizing recent research in southwest Idaho, and includes a preliminary report on the excavations at Givens Hot Springs where three separate Archaic components were located with large pit houses.

Extensive excavations have recently been conducted at three historic sites. Portions of the Boise China Town were excavated with funds from the Boise Redevelopment Agency and the Idaho SHPO (Jones 1980). Extensive Chinese materials were also uncovered in the Idaho City excavations (Jones, Davis and Ling 1979). The Corps of Engineers sponsored research at the Mary Hallock Foote House just east of Boise (Jones 1982; Knudson et al. 1982).

Research Questions

In addition to the investigations mentioned above, there are a number of other research topics currently being investigated in southern Idaho. First may be mentioned recent concern over the presence of Fremont Culture materials. A number of artifacts characteristic of Fremont have been identified in southern Idaho; this has led to a great deal of controversy and the matter is yet to be settled (Butler 1979, 1981, 1983; Plew 1979b, 1980b, 1984). The second major area of new research is in obsidian sourcing and hydration. The Idaho SHPO has funded a number of sourcing and hydration projects. Summaries of this research can be found in Sappington (1981b; 1984) and in J. P. Green (1982). Another area of research is the analysis of burial collections in southwestern Idaho. This research has led to the formulation of the Western Idaho Burial Complex, defined by elaborate burial goods (Pavesic 1985). More recently, Richard Holmer (Idaho State University) has begun a project to identify the archaeological traces of Shoshonean occupation in southern Idaho. A late prehistoric site on the Fort Hall Reservation was excavated in 1985 in connection with this project.

Regional Planning

Articulation of State and Regional Plans

Southern Idaho could certainly benefit from research designs that cross state lines. As recent research has shown, the archaeological records of southeastern Idaho and northern Utah have a great deal in common. The eastern Snake River Plain clearly has connections with the High Plains of Montana and Wyoming, especially in the earlier sequences. And, there is no basis to divide southwestern Idaho from eastern Oregon; the state line is an arbitrary border. The only portion of southern Idaho that might exist as an independent subregion is the central portion of the state, from the Hagerman Valley north to Camas Prairie. However, even this area may have some ties to northern Utah at various times in the past.

The use of the Intermountain Antiquities Computer System (IMACS) standardizes the collection of survey data throughout southern Idaho. The development of region-wide research questions could also provide more uniformity in the collection of other information.

The development of state plans through the RP-3 process can clearly incorporate region-wide research designs. The SHPO review process can make sure that these research designs are incorporated into Federally funded research and mitigation projects. The BLM and the Forest Service can identify these research designs as priorities in their planning process. While this is all possible, there must be assurance that the regional research designs would not be applied in a rigid manner. This clearly would inhibit the development of new ideas.

Interaction with Land Use Plans of Major Agencies

BLM and Forest Service archaeologists help prepare planning documents and can insure that regional and local research questions are addressed; the SHPO usually reviews drafts of the documents. Also, professional archaeologists, as part of the general public, can become involved in the planning efforts of Federal and state agencies. Almost all Federal and state archaeologists would welcome the support of academic archaeologists.

Use of Predictive Models in CRM

Full scale predictive models have not been developed or tested in southern Idaho. They would have the most utility in guiding the level of survey needed in different environmental zones for federal compliance.

Communication with Native Americans

For archaeologists working in Idaho communication with Native American peoples has become an operational necessity. The excavation of Native American burials in Idaho requires the notification of the Director of the Idaho State Historical Society and the permission of the appropriate Indian group. Only in situations where the burial is endangered can an archaeologist excavate without the permission of Native Americans. In addition the federal agencies are required to give Indian people an opportunity to comment before issuing permits under the Archaeological Resources Protection Act. Representatives of the federally recognized tribes in Idaho are invited to attend the semiannual meetings of the Idaho Advisory Council of Professional Archaeologists.

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Fig. 1. The Western Utah Subregion.

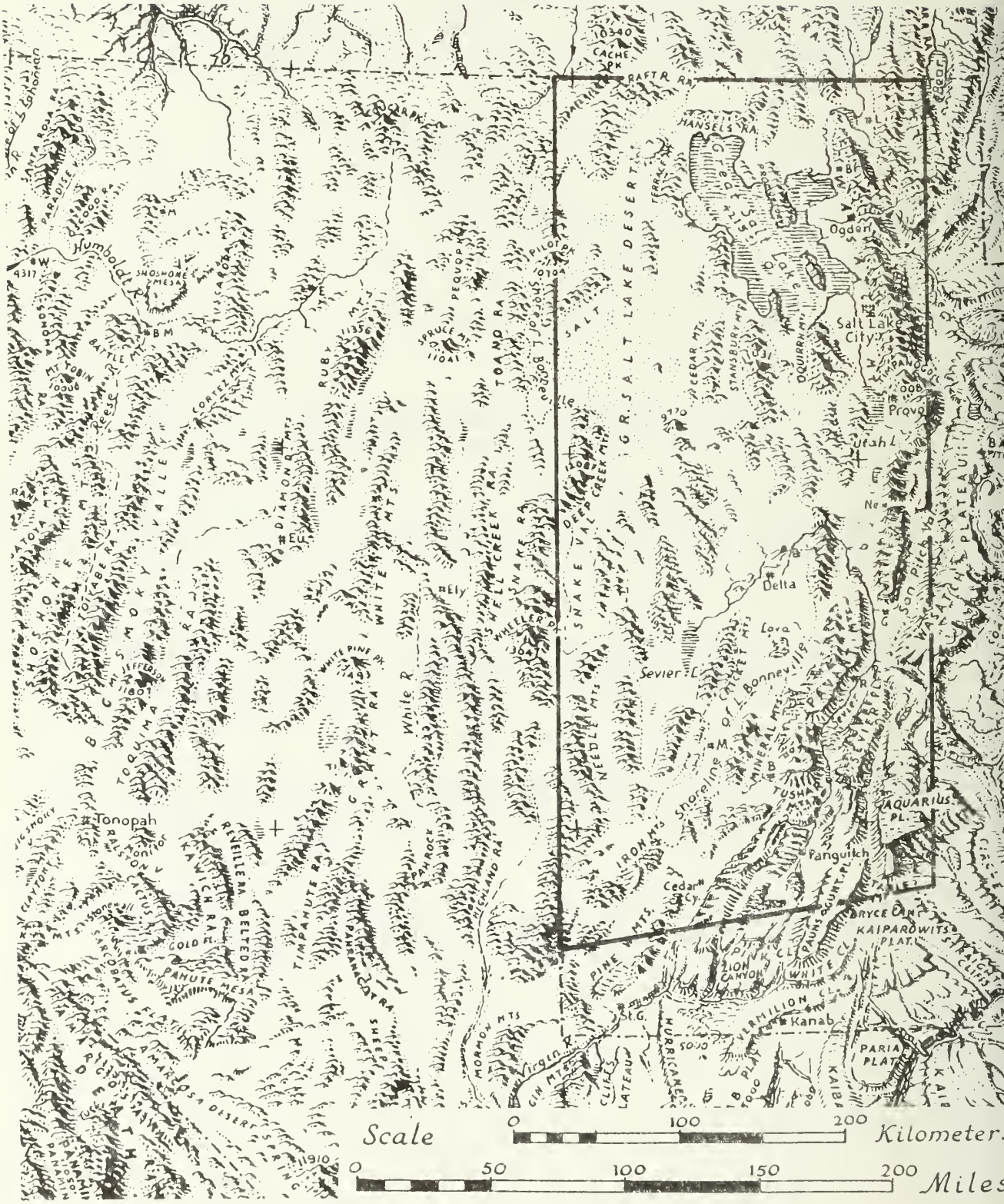

Fig. 1. The Western Utah Subregion.

WESTERN UTAH

by

James L. Dykman

The Subregion

Utah's prehistory includes Lithic, Archaic, and Formative stage cultures.

Evidence for hunters of the Lithic stage is limited in Utah, as in other parts of the Great Basin. An example is site 42MD300, a National Register-listed site in a 1/2 mile long sand blowout with associated points. Desert Archaic hunter-gathers are represented at many sites such as Danger Cave, Hogup Cave, Sudden Shelter, and others (Jennings 1978). The Fremont culture replaced the Archaic peoples over most of Utah except in the far south, where Anasazi cultures were established at about the same time. The Fremont has been divided into subgroups based on trait lists. Madsen (1979) has suggested, based on subsistence, that there are three groups: the Sevier, the Fremont, and a Plains-affiliated culture. After the abandonment of Utah by Fremont and Anasazi horticulturalists, Shoshoni speakers replaced them in the Great Basin; these are the Southern Paiute, Gosiute, and Ute.

State Plan

A preservation plan for the State of Utah was developed in 1975, but its focus and application was historic. By direction of the Heritage Conservation and Recreation Service in 1979, a Budget Document replaced the old Statewide Plan. No RP3 document has been completed for Utah, although the Utah Preservation Research Office has begun consideration of the structure of the plan and staff members have attended several workshops to determine Park Service direction. In Utah, the regional data base has not yet been brought into a planning process.

RP3 Development

The Resource Planning Protection Process (RP3) has been limited in Utah, but work has begun in two areas: local historical groups have agreed on themes to be considered by the professional community, and the Utah Professional Archaeology Committee has developed a subcommittee to work on regional research designs. Additionally, State personnel have attended National Park Service workshops on RP3. Under current conditions, development of an RP3 plan would require a request to the Utah State Historic Preservation Office by the National Park Service.

Sources of Existing Records

Archaeological records are located in Federal and state repositories. The following is a list of those locations. The records may be duplicated in some cases.

1. Utah State Historical Society, Salt Lake City: Statewide IMACS forms (see Lichty, this volume), earlier site forms, plotted site maps, and plotted surveys are located here. The material is composed of both paper and computerized files. The files, open to all interested professionals, are located at 300 Rio Grande, Salt Lake City. The potential for regional computerization is good.

The Department of Anthropology at the University of Utah maintains similar records.

2. Museums: Two museums in the state of Utah contain material site information:

A) Southern Utah State College Museum of Anthropology, Cedar City, Utah. Files contain duplicate site forms for archaeological material located in southwestern Utah, and collections from CRM projects completed in the area. The files are paper files, and there is potential for computerization.

B) Edge of the Cedars Museum Blanding, Utah. Part of the Utah State Parks program, this museum has a partial collection of site forms concerning mostly the Mesa Verde and Kayenta Anasazi cultures, with some Great Basin site material. The forms are paper files and computerization is possible.

Other museums in the state contain some site forms and curate for CRM projects. These include the Price Museum of Natural History, Price, Utah; Brigham Young University's Museum of Peoples and Cultures, Provo; and Anasazi State Park, Boulder, Utah.

2. Federal Repositories: Two federal agencies in Utah are sources of existing records; the Bureau of Land Management and the U.S. Forest Service.

A) The BLM has offices in many cities in Utah; those with records pertaining to the Great Basin are: Salt Lake City State Office (central repository for Northwest Utah); Richfield BLM (West Central Utah archaeological and environmental records); and Cedar City, Utah BLM (Southwestern Utah). The BLM State Office files are mostly on computer, with the rest of the offices having paper files that can be computerized.

B) Forest Service: The Forest Service maintains IMACS records and artifacts from its surveys. The Regional Office in Ogden has responsibility for forests in Southern Idaho, Nevada, and Utah. In Ogden, information is stored from the Dixie and Fishlake National Forests, the two Utah forests in the Great Basin. Duplicate files are also available at each forest office. The Dixie office is headquartered at Cedar City, and the Fishlake office at Richfield, Utah. The local offices have paper files, with the possibility of computerization of those files.

In the Great Basin portion of Utah, coverage is mostly at the level of reconnaissance surveys, conducted in response to Federal CRM regulations. Little sampling work has been done except for the MX surveys in 1980, 1981 and 1982. In Utah the largest gap in areal information is in the

Southeastern Great Basin corner of the state, where published data on survey and excavation are limited. Temporal gaps in information are in the Lithic stage and the Numic period.

Collections

Artifact collection policies in Utah have moved from the "vacuum cleaner" approach encouraged or tolerated by the BLM and Forest Service in the early 1970s, to a non-collection policy on most intensive or sample surveys. Utah's present policy could generally be seen as a non-collection policy. Information about the policy can be obtained from Jerry Wylie (U.S. Forest Service) or Forest Service archaeologists in Vernal or Richfield; and Richard Fike (BLM State Archaeologist). On State land a non-collection policy has generally been requested since 1973; information can be obtained from LaMar Lindsey.

Environmental Data

Soils maps, USGS maps, vegetation maps and related material are available in several areas of the state. BLM district offices and U.S. Forest Service offices have soils information, maps, and photo coverage for each of their respective districts. In addition, environmental information is maintained by the State Department of Natural Resources in Salt Lake City. Complete sets of USGS maps can be obtained from the Utah Geologic Survey and the U.S. Geologic Survey offices, both located in Salt Lake City. The USGS coverage is good, though the 15 minute series maps are out of date. For the Great Basin part of the state, coverage is mostly in 7.5 minute quadrangles and areas covered only by 15 minute maps are limited.

Paleoenvironmental Data

There is no center of location for paleoenvironmental materials. Glacial records and data on geomorphological sequences are kept by the Utah Geologic Survey. Pollen records are kept at the State Archaeologist's office in Salt Lake. Other agencies may have information, but there are no central records on vegetation or faunal sequences.

Historic Archaeological Records

Historic archaeological records are located in the same repositories as all archaeological records; they are not placed in separate categories.

Photographic Archival Records

The Utah Historical Society library is a repository for photos and historic archival materials. The collection contains approximately 8,000 historic photographs and maintains duplicate materials of HABS and HAER projects in Utah.

Summaries and Syntheses

There are several overviews of early Utah prehistory. Jennings' (1978) publication on the Eastern Great Basin is widely known, and a

valuable bibliographic source. Discussions of settlement pattern, chronology, spatial divisions and other models are provided by Jennings and other authors such as Madsen and O'Connell (1982).

Research Priorities

No research priorities have been formalized in the state plan or in predictive models. Research priorities concerning subsistence in the Fremont, Numic, and Archaic cultures have been outlined by the State Archaeologist. In ongoing research, Intermountain Power Project power line mitigation work has produced a research design that utilizes many of the MX research program's design concepts.

Predictive Modeling

The potential for predictive models in the Eastern Great Basin is currently restricted; predictive modeling is perhaps the least understood principle in Utah CRM. There is a great potential for models, but little current expectation of development.

Regional Research Designs and Plans

As mentioned, the Utah Professional Archaeology Committee has established a subcommittee for the development of regional research plans and designs. Considering the background of those concerned with CRM and the success of IMACS, the potential for development of long term plans and designs is good, but the effort will be costly.

Communication with Native Americans

The State of Utah has an Office of Indian Affairs that serves as an initial point of contact with Native Americans in CRM matters. The tribes concerned with the Great Basin in Utah--Paiute, Ute, and Gosiute--have each identified a contact person for review of CRM material. Federal and state agencies use these contacts with an uneven approach. The Utah Department of Transportation is most consistent in the involvement of tribal members in its projects, through consultation and employment of tribal members on field crews.

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INTERMOUNTAIN ANTIQUITIES COMPUTER SYSTEM

by

Alan S. Lichty

Introduction

IMACS is an acronym for the InterMountain Antiquities Computer System. The implications of this name have caused a great deal of confusion as to exactly what IMACS is and is not; therefore it seems appropriate to start out this discussion by describing what IMACS is and how it works. Computer System is perhaps a poor choice of words since there is no computer or software system that can actually be called IMACS. Rather, IMACS is a data sharing system in which several institutions and agencies use a common data pool to feed data base programs on a wide variety of computers using an equally wide variety of resident software systems. The divergency of these various computer systems is actually the basis of IMACS. Thus, IMACS is almost exactly the opposite of a computer system and instead is the means by which we can tie together several computer systems which otherwise are too different to share a common data set.

The History of IMACS

The first effort at creating a major machine readable data set for Cultural Resource Management in Utah was probably the REX data set for the Bureau of Land Management. In 1979, the University of Utah contracted with the BLM to encode archaeological sites in major geographic areas of the state for the REX system. In the process of this work, the University made an effort to build a larger machine readable data set by expanding on the information required for the BLM's REX program. A computer program was written to extract the REX data set from the University's version so that the BLM's computer could read in the REX data. While the University spent some of its own money to finish this contract, it ended up with a data set for research purposes that cost considerably less than if it had been built from scratch. The Utah State Historic Preservation Officer, in an effort to avoid a similar expense, approached the University to access the University's data set for historic preservation compliance purposes. Further contracts with the BLM initiated completion of the encoding of Utah archaeological data. A site form was designed that contained the information of both the BLM and the Utah SHPO so that future site recording would directly feed into the University's data set and the existing program could continue to extract the data for the BLM computer. This data set and its associated programs was ultimately named the Archaeological Resource Inventory System (ARIS) and served as a prototype for the IMACS data set and computer information exchange.

In 1981, the Intermountain Region of the U.S. Forest Service began inquiring about the possibility of extending the distribution process so that it could economize on building a data set on the Forest Service computer system. The idea sounded feasible so several meetings were held to discuss how to accomplish this. Since the Forest Service's

Intermountain administrative region covers Nevada, Utah, and parts of Idaho, Wyoming, and California, it seemed expedient to invite other agencies in these areas to join the discussions. Almost all of these agencies were facing the identical problem of computerizing vast amounts of old data, and the idea of sharing the cost and effort was agreeable to them.

Using the ARIS data set for Utah as a starting point, the proposed data set was expanded to include enough information to cover sites for the larger geographic area of Idaho, Nevada, Utah, and parts of Wyoming and California. While the old ARIS site form was the starting point, the newer site form that resulted was quite a bit larger and recorded more information with better defined data categories. This IMACS site form, instructions for filling it out, and data encoding values were put into a handbook called the IMACS User's Guide. A copy of this handbook was sent out to each agency, contractor, and institution known to perform work within the geographic area encompassed by IMACS. In 1983, the addition of the rest of Wyoming to accommodate the BLM and SHPO for that state caused considerable revision to the layout of the 1982 site form and additions to the encoded data.

Since site forms often have to be changed to reflect what we have learned about the sites that we are recording, the IMACS Council, consisting of a representative from each agency sharing in the data, was established so that proposed changes in the data set could be reviewed in an orderly fashion and everyone with an invested interest could have input on the proposal. This council meets twice a year (once in the fall and again in winter) to discuss and implement alterations in the site form and data set design. The University of Utah currently does all actual edits to the User's Guide, utilizing a word processing program. An update packet is sent each spring to each holder of an IMACS field handbook; this contains the alterations for the next field year based on the winter IMACS Council meeting. Some changes were made to the data set in 1984 and updates were made to the handbook in 1985, but 1985 is the first year that has seen no changes in the encoded data set format.

While it is fairly easy to build a site form that includes a lot of information, the problem of utilizing the data on a computer presents far more acute difficulties. The politics of which agency has access to which computers is quite complex and each agency has a set of rules that must be followed. An example of this is the Utah State Office of the BLM, which is required to use either the agency's computer facilities in Denver or its own facilities within the state office. Funding for using other computer installations is not available. The Forest Service has similar mandates to use its computer in Fort Collins, Colorado. The net result is that each respective agency must use a designated computer, so the idea of sharing a specifically archaeological computer with a copy of all of our data cannot be entertained. Adding to the logistics problems of using many different computers is the fact that agencies utilizing designated computer systems must also work with existing programs available to their specific machines. Data base management software for large computers is quite expensive and there is little or no funding available for the procurement of a program package that would be common to all IMACS data users. Thus, the

differences between programs used to manipulate the data are actually greater than the differences in the computer hardware and this directly affects the process of reading the data into each target computer. To overcome this problem, a mechanism very similar to that by which REX data were translated from ARIS was established.

The easiest way to describe how the computer interchange works is to trace where the data from the site form go. Encoded data are keyed into a computer file as they appear on the encoding sheet of the IMACS site form. These data are then transferred to the University of Utah where they are sorted and split up into a variety of files. Copies of the data are then sent out to the various IMACS members in a tape format suitable for loading into each of the various agency/institution computers. The exact format of the data sent out is a function of the loading requirements for each computer system that is to take the data.

By creating a "buffer" between data collection and distribution, the site form can absorb necessary changes for new data collection needs and the various member agencies can determine for themselves whether or not to reprogram their systems to match. There is often a considerable time lag between the design phases and actual implementation of a computerized data base system. This lag, coupled with the time necessary before data will actually come into the system, can mean that by the time a new data base system is ready to be implemented, the site form for current data has already changed and the "new" system is not current as of when it first can be used. Changing the newly created system usually must be postponed until all of the original data have been loaded, and unless an agency has a full-time programmer at its disposal, the changes may have to be scheduled for a later date. IMACS acts as a filter for any participant in such a situation in that it will continue to provide new data in the manner specified by the original design until the agency/institution decides to (or can) make changes in its data format. Since a master copy of the entire data set is always kept in the newest format, any IMACS member wanting to rewrite its entire data set to match a new format can do so when it suits agency needs and budget.

The IMACS Data Set

The IMACS data files represent an inventory data set. This is to say that the data set reflects an inventory of what is known about each site (in categorized terms) and what was found in that site. The main use of a copy of the IMACS data set is usually for CRM-oriented literature searches. These often take the form of data searches based on locational information (townships and ranges/UTMs). Inventory data can prove quite useful for research as well. While computerized data are often too general in their categorizations of reality, data searches on inventory items can rapidly isolate the site numbers of sites containing items of interest. These numbers can then be used to pull the site forms so that the original verbage can be viewed in its more infinite wisdom. When combined with plotting capabilities in computer graphics, inventory data files can be used to generate distribution maps of almost any type of data category within the data set. With the exception of very well surveyed areas, it is usually the case that straight plots of all known sites are more likely to

be informative about simply where mitigation work has taken place than about prehistoric settlement patterns, but when combined with data selection, relative distribution patterns become more clear.

On a relative scale, the IMACS data set is a rather simple one. Some mainframe computer data base programs (such as SYSTEM 2000) can support very complex data structures that could allow one literally to "zoom in" on a single site, and could provide a second-level data set to deal with excavation data by stratum for that site if such information is available. Data structures that allow one to make multiple logical levels out of the data and organize the actual data according to the defined levels are called hierarchical. Those that allow one to relate the current record information to another data file are called relational (note that this is a VERY broad definition--more detail would serve no purpose for this discussion).

While these more complex data structures can often be more useful than simple schemes, a combination of circumstances dictates that IMACS remain simple. First of all, not all agencies that use the IMACS data set have access to the necessary software to support more complex schemes. The current format of the data set as it is exchanged between computers takes into account the fact that some agencies do load a hierarchical data base from the IMACS tape while others use simpler schemes. The other main reason for using a non-hierarchical data design in IMACS is the nature of the archaeological remains that are recorded in survey work. For the vast majority of the sites that occur within the geographic area covered by the IMACS site forms, most of the artifacts recorded are non-diagnostic and there is simply no way to assign them to a specific time period. Euro-american remains are easily distinguished and thus, the artifact and feature inventories are recorded separately from the prehistoric component inventories (if present). Thus, there is a logical split of the IMACS data into Administrative/Environmental data (common to all sites), and site component data which can be prehistoric, historic, or both. This is the only real hierarchical aspect to the IMACS data. There are some cases (especially in southeastern Utah) where a data set with more site component inventory hierarchies would probably be desirable, but such sites are too few within the current IMACS geographic area to be of concern.

Since there is no information in the IMACS data set about surveyed areas where no sites have been found, there are a number of limitations in regard to what kinds of research can be conducted using these data. While it is nice to be able to say that all Archaic sites within a certain study area are on a specific type of landform, it wouldn't be very useful information if it turned out that 90% of the study area had that type of landform and 98% of the area covered by that landform was without sites. Computer data sets for research modeling usually take the form of data cells representing a geographic area in question with information about the environment. This type of data is highly dependent on the nature of the study being conducted, especially in terms of the size of the ground study unit employed and the types of information that are required for the analysis. Because of the highly specialized nature of geographic area data, these data are not included in the IMACS data set. IMACS data can be combined with such information within a computer system to make a new data

file for such purposes. Combined with a Geographic Information System (GIS) software package and information about surveyed areas, IMACS can be very useful for rapid inclusion of site inventory data.

The Current State of Affairs

IMACS is still catching up to encoding efforts initiated in 1982. When IMACS was first formalized in 1982, the University of Utah had some 12,500 sites in its ARIS data files that contained many of the data items now present in the IMACS site form. These sites were converted into the storage format for IMACS to offset initial encoding costs. At the same time, archaeologists in Idaho and Utah were contracted by the U.S. Forest Service and the BLM to encode data not covered by the University's existing data set. Portions of these contracts and subsequent ones have resulted in placing about 27,000 total sites online. A large number of site records are still in the process of being keypunched (the biggest bottleneck of the data entry system) and the total number of sites should approach 50,000 by the end of summer, 1985. Currently, the Utah subset of IMACS data is the single most complete, with over 20,000 sites included. Almost all old Utah site forms have been accounted for (with some still being keypunched) and the data are current up to 1982 with some 1983 data now being added. Idaho has a little more than 5,000 sites online with a considerable number still tied up in keypunching. Nevada did not start encoding efforts until 1983 and most of the 1983 data are still in the process of keypunch entry. There were about 500 Nevada archaeological sites in the University of Utah data set in 1981 that were converted into the IMACS format and about 1100 more have recently been added. Data from the 1984 field version of the site form were only sent to be keypunched within the last few months and none have yet been entered.

Clearly the actual process of keying the data into computers has proven to be the largest stumbling block to getting IMACS out of the design stage and into full implementation. We have originally anticipated a lag of about two years between the start of the encoding projects and the time when the majority of the data would actually be online. While this was a reasonable estimate based on smaller projects that we have worked with in the past, it did not prove to be accurate for the IMACS case. A mixup on site forms in early 1984 led to a long delay in resorting and rekeying large quantities of 1982 and 1983 encoding forms. The problems leading to that situation have been straightened out and the 1983 data are being reentered, but the net result of the mixup is that we are about 8 months behind our anticipated schedule for full implementation. I estimate that we will have almost all outstanding sites through the 1984 field year online by fall 1985. To emphasize the highly fluctuating nature of writing about current status, while I have been writing this text, two more boxes of data tapes have been delivered to me. This means that by the time anyone is reading this text, the number of sites online will not be the same as those numbers presented above. Growth of the data base is continual.

The Future of IMACS

There is still a lot of work to be done before we can realize the full implementation of IMACS as it has been designed. Numerous member agencies have yet to set up data systems to take what data we already have and others are waiting until more of the data are available before initiating such efforts. Hopefully, many of these situations will be cleared out by late 1985 when we have more of the data online. At that point, extensive evaluations of the information currently being recorded in the field using the IMACS site form will be performed by several agencies so that we can make some intelligent decisions about the current collection of variables. At present, the utility of several variables currently on the IMACS site form is being questioned. As of the 1985 winter meeting of the IMACS Council, it was decided to wait on deleting these variables until we had the data online and could assess their utility in the data set.

After the current backlog of old site data is caught up, new site data will be sent to each IMACS member with online data at intervals of about 6 months to update local data sets. In an effort to keep the master copy of the IMACS data set up to date, each member agency with data will be cajoled to unload a copy of its online data (with all of the local correction edits) back to the University of Utah where any corrections can be merged back into the master copy for future reference. This will allow us to maintain an up to date copy so that requests to rewrite a member agency's data set can take the corrections into account and not require major keyboard sessions to get the new data online.

For a variety of reasons, there has been to date no publication that actually described IMACS as it has been presented here. As was mentioned above, IMACS is subject to change every year. This fact, coupled with the usual time lag for publications, meant that anything that came out in print was almost guaranteed to be out of date by the time anyone read the article. It cannot be emphasized strongly enough that many parts of this discussion will suffer the same fate.

PALEOENVIRONMENTAL MODELING AND GEOARCHAEOLOGY

by

Lonnie C. Pippin

An understanding of an archaeological site's natural context is a prerequisite for its proper interpretation and the evaluation of its scientific significance. This natural context includes the characteristics and processes of the lithosphere, biosphere and atmosphere and should be viewed from both a site specific and a regional perspective. Like culture, however, the natural environment is dynamic and not only may have changed in its character through time, but also may have changed in the way that it has influenced the nature of cultural resources. Great Basin archaeologists have long recognized that there have been significant changes in the environment of this now-arid region and have frequently used models of past environmental change to explain cultural behavior (Antevs 1948; Baumhoff and Heizer 1965; Elston 1982; Layton 1972; Moratto, King and Woolfender 1978; O'Connell 1975; Thomas 1983:500-529). More recently, Great Basin prehistorians also have proposed models, such as those based on optimal foraging theory (Pyke, Pulliam and Charnov 1977), that focus on discerning how particular environments and the nature of resources in those environments shape cultural adaptations (O'Connell, Jones and Simms 1982; Thomas 1983).

But, just as the natural environment may have influenced the nature of cultural development, that cultural development equally may have influenced the nature of its natural environment. The role of ancient hunters in the extinction of Pleistocene megafauna is perhaps one of the best known, if not debated, examples of how past peoples in the Great Basin may have influenced their environment (Martin and Klein 1984). Other examples might include the depletion of toolstone at available quarries (Jackson 1984; Pippin 1984:228-229; Singer and Ericson 1977), the deforestation of woodlands for mining timbers (Hattori, Thompson and McLane 1984), or the control of surface runoff by the alteration of desert pavement in areas of low rainfall (Dansie 1981). Consequently, consideration of the reciprocal relationship between the natural environment and cultural adaptation should be an integral part of all cultural resources management plans and research designs.

Mehringer (1977) has presented an excellent review of the evidence for the magnitude and chronology of past environmental change in the Great Basin during the Late Quaternary, and that paper provides the baseline for this review. Furthermore, Wright (1983) has recently compiled a major synthesis of Late-Quaternary environments in the United States that updates and revises his earlier contribution (Wright and Frey 1965). Bryant and Holloway (1985) have edited a compendium of Late Quaternary pollen records in North America that contains review articles on records from the western Great Basin (Adam 1985), the northern Great Basin (Mehringer 1985) and American Southwest (Hall 1985a, 1985b). Finally, Madsen and O'Connell (1982) have published the results of a symposium on man and environment in the Great Basin that includes paleoecological models from the southern

Great Basin (Weide 1982), northeastern Great Basin (Currey and James 1982) and western Great Basin (Davis 1982a) as well as a review of the faunal evidence for biogeographic and paleoenvironmental change during the last 15,000 years (Grayson 1982). Rather than attempt to review the evidence or even present brief synopses of various models, then, this paper only attempts to provide a guide to the paleoenvironmental and geoarchaeological literature published since Mehringer's (1977) review. During this exercise, I will also point to avenues of archaeological research that may assist paleoenvironmental modeling, or to paleoenvironmental models that may assist in cultural resources studies.

Great Basin Climates

Before reviewing the literature concerning past climate, it may be useful to consider what is known of today's climate in the Great Basin. Houghton, Sakamoto and Gifford (1975) have summarized Nevada's weather and climate; the Pacific Northwest River Basins Commission (1968) provides information concerning the climate of the Great Basin in Oregon and Idaho; Jeppson et al. (1968) outline the climate of Utah and the U.S. Department of Commerce, Weather Bureau, has provided synopses for California (1959), Oregon (1960) and Utah (1960). Climatic conditions in the Great Basin are significantly influenced by the distribution of continental and maritime air masses and by regional rain-shadows produced by the Sierra Nevada, southern Rocky Mountains and many of the Great Basin ranges themselves (Houghton 1969:5-11; Houghton, Sakamoto and Gifford 1975:8-19). Using mean monthly values of equivalent potential temperature, Mitchell (1976, Fig. 3) has divided the western United States into six climatic regions, two of which fall over the Great Basin. According to Mitchell (1976:925-926), today in the region north of approximately the northern borders of California, Nevada and Utah, climate is affected by the frequent intrusion of cool, moist Pacific air masses during the winter, but is under the influence of relatively warm and dry continental air masses during the summer. In contrast, climate in the portion of the Great Basin south of this gradient boundary is characterized by the infrequent intrusion of Pacific air during the winter and by continental air masses during the summer which in the Southern Great Basin may include warm, moist monsoon air from the Gulf of Mexico and Gulf of California. As argued by Aschmann (1958) over two decades ago, an understanding of these atmospheric circulation patterns and the geographical influences of latitude, elevation and continentality is a prerequisite for reconstructions of past climatic change.

Geological Studies

Fluctuations of Ancient Lake Levels

Anthropologists have typically defined the Great Basin to include areas drained by both the Columbia and Colorado river systems (Figure 1); nevertheless, hydrologically it is restricted to an area of internal drainage within the Basin and Range physiographic province (Hunt 1968). Whenever water runoff and ground water inflow into sinks exceed moisture output (evapotranspiration, ground water outflow), this drainage pattern has resulted in the formation of lakes. The fact that fluctuations in the existence, extent and depth of lakes may directly reflect past climate has

been recognized for almost three centuries (Halley 1715), but scholars continue to differ in their opinions regarding the importance of the various climatic factors which may be involved (Mehringer 1977, Table 1; Mifflin and Wheat 1979:8-10; Smith and Street-Perrott 1983, Table 10-1).

Although total annual precipitation most directly influences the amount of water inflow to a lake, several other factors may also affect total water input into the system. These factors include such things as the seasonal distribution and intensity of precipitation, whether it falls as snow or rain, the nature of soil and/or vegetation cover, mean annual and seasonal temperatures, local topographic relief and slope angle, the nature of local and regional ground water systems, and the degree of annual and/or long term variability in these factors (Smith and Street-Perrott 1983:191-192). Evaporation--influenced by lake surface area, water and air temperatures, absolute humidity, duration and intensity of solar radiation, wind velocity, water salinity, etc.--is likewise not the only factor controlling water outflow. Regional ground water flow systems, evapotranspiration from surrounding phreatophytes and moist soils, tectonic uplift, erosion, volcanic eruptions, landslides, etc. also may affect local hydrologic systems and lake levels. King (1978), for example, has suggested that the diversion of the Walker River through Adrian Valley into the Carson River, rather than climate, may have been responsible for the dessication of Walker Lake during the early Holocene (Davis 1982a:63-64).

Mifflin and Wheat (1979:10-11, Plate 1), based on ancient shore line features visible in areal photographs, have suggested several revisions to previously published maps of Pleistocene lakes in the Great Basin (Hubbs and Miller 1948; Snyder, Hardman and Zdenek 1964). However, Smith and Street-Perrott (1983:203-204, Fig. 10-1) call for more dated sedimentologic and stratigraphic data and illustrate a different version of lake distributions. Pluvial lakes Bonneville, Lahontan, Searles and Mohave continue to be the best studied of these Pleistocene lakes. Thompson, Benson and Hattori (1986) present a revised chronology for the central Lahontan Basin, using data from tephrochronology (Davis 1983a), radiocarbon dates on lithoid tufa and gastropods (Benson 1978, 1981), dates on nontufa carbonates (Broecker and Orr 1958; Broecker and Kaufman 1965), radiocarbon dates on wood from Truckee River deltaic sediments (Born 1972), and dated packrat middens (Hattori 1982). During the last decade, Currey (1980a; Curry, Atwood and Mabey 1983), Scott *et al.* (1983) and Spencer *et al.* (1984) also have presented revised chronologies for pluvial Lake Bonneville. Smith and Street-Perrott (1983:197-199) review lake level histories for Lake Russell (Mono Basin) and Searles Lake in the Owens River (Death Valley) System. Smith (1984), based on a 930 m core from Searles Lake, postulates nine paleohydrologic regimes in the southwestern Great Basin during the last three million years or so.

Studies during the past decade have not only increased our knowledge of these famous lakes, but also of several other less well known pluvial lakes. Based on sedimentological and mollusk data, Quade (in press) has interpreted the fine grained sediments in the Las Vegas Valley to have been deposited in spring fed marsh and wet meadow environments rather than by a pluvial lake (Haynes 1967:78). Allison (1979, 1982) has completed his reports on pluvial lakes Chewaucan and Fort Rock in Oregon. Mehringer and

Sheppard (1978) have presented a Holocene history of Little Lake, in the Owens River system. Finally, Wells et al. (1985) have studied late Quaternary Lake Mojave deposits and shorelines around the Silver Lake playa.

Several archaeological studies have also increased our knowledge of Holocene lake fluctuations in and around the Great Basin since Mehringer's (1977) review. Davis and Pippin (1979), for example, offer a history of lake fluctuations and changing wind directions for Eagle Lake, California; Hattori (1982:23-36) relates past fluctuations in Winnemucca Lake to human occupation at Falcon Hill; and Tuohy and Clark (1979:7) provide radiocarbon evidence for a low stand of Winnemucca Lake at 2480 B.P. Archaeological sites on the Bear, Malad, and Weber river deltas have continued to provide extremely valuable information concerning Holocene fluctuations in Great Salt Lake (Fry and Dalley 1979; Shields and Dalley 1978). Wilke (1978) and Waters (1983) have presented chronologies for Holocene fluctuations in Lake Cahuilla and their relationships to human occupation; and Davis and Elston (1972) and Davis, Elston and Townsend (1976) have used archaeological evidence to postulate past fluctuations in Lake Tahoe. These studies illustrate that archaeological surveys and excavations in areas occupied now or in the past by lakes may provide significant information regarding ancient lake levels.

Glaciation

Mehringer (1977:123) points out that the chronology and magnitude of alpine glaciation also may provide valuable information concerning ancient environments and cultural adaptation in the Great Basin. For example, Bettinger (1977, 1982) has used Curry's (1969) model of neoglacial advances in the central Sierra Nevada to postulate man-environmental relationships in the Owens Valley and Inyo-Mono regions. Conversely, studies of archaeological sites may provide clues relevant to discerning the nature of past glaciation. For example, radiocarbon dates from an archaeological site situated on the inner slope of a Tioga terminal moraine in Squaw Creek provides a limiting date on that glacial advance (Elston et al. 1977:138-153). But, as in the case for pluvial lakes, scholars continue to disagree concerning the climatic parameters responsible for glacial environments in the mountains of the western United States (Galloway 1983; McCoy 1981).

Recently, Porter, Pierce and Hamilton (1983) have reviewed the evidence for Lake Wisconsin glaciation in the mountains of the western United States and Burke and Birkeland (1983) have examined Holocene glacial activity in the same areas. Burke and Birkeland (1979) provide a map showing the extent of Late Pleistocene glaciers in the Sierra Nevada and have reevaluated their relative chronologies. Dalrymple, Burke and Birkeland (1982) revise that chronology with K-Ar dates on basalt flows in Sawmill Canyon. Yount, Birkeland and Burke (1979) provide a brief synopsis of glacial and periglacial deposits in the Mono Creek area of the west-central Sierra Nevada. Finally, Piegat (1980) has mapped the extent of glaciation on the Snake and other ranges in the central Great Basin.

On the other side of the Great Basin, Madsen and Currey (1979) have dated a soil buried by a Pinedale terminal moraine at the foot of Bells

Canyon in the Western Range that most likely reflects a minimum age for that Late Wisconsin glacial advance. In addition, they provide evidence that several of the higher altitude Holocene tills in Cottonwood Canyon may be older than Richmond (1964) originally thought. More recently, Anderson and Anderson (1981) have studied Holocene glaciation in the Mount Timpanogos area of the Wasatch Front. Finally, although his work has been largely confined to the Colorado Front Range, Benedict's (1981) research clearly illustrates the value of archaeological data for dating glacial episodes, and the uncertainty associated with models purporting to provide world wide or even Great Basin wide glacial chronology.

The high mountains and cold steppes in the Great Basin exhibit substantial evidence of active and inactive periglacial features such as patterned ground, frost-stirred sediments, involutions, rock streams, rubble sheets, talus slopes, nivation hollows and other mass-wasting phenomena (Atwood 1909:63; Blackwelder 1935:317; De Graff 1976:116; Dohrenwend 1984; Flint and Denny 1958:133; Malde 1961, 1964; Richmond 1962; Rupel and Hait 1961:B-164). Dohrenwend (1984) has recently proposed that elevational trends in the nivation landforms on Great Basin mountain ranges may reflect about a 7°C depression in mean annual temperature during full glacial conditions. Similarly, Wayne (1983) has suggested that the paleocryogenic features in western Nevada reflect glacial temperatures 5 to 6°C cooler than those of today. However, as pointed out by Pewe (1983:179-180), other periglacial features in the Great Basin are poorly studied. With the current emphasis on high mountain archaeology in the Great Basin (Thomas 1982a), it is becoming increasingly important to understand not only the history and processes of periglacial phenomena, but also their effects on cultural adaptations and archaeological sites. Even at lower elevations, seasonal freeze-thaw cycles may significantly turbate cultural remains, and studies of the rates, depth, and magnitude of such frost turbation are necessary.

Other Paleohydrologic Studies

Potable water was a vital resource for the ancient peoples who occupied the arid Great Basin. Based on Birdsell's (1953) pioneering research among the Australian aborigines, Thomas (1972:140-141) has examined the relationship between population density and precipitation in the Great Basin. But, unlike Birdsell, he reports only a general correspondence between these variables and his data resulted in a relatively weak statistical correlation. Hence, unlike Australia, water availability in the Great Basin cannot be measured simply in terms of precipitation. Complex ground water systems, including interbasin flow and aquifers charged by ancient pluvial lakes, have resulted in numerous springs and seeps whose discharge may bear little correlation to modern day precipitation values. Although several Great Basin archaeologists (Fagan 1974; Hall 1981; McGonagle and Waski 1978) have inventoried the springs and seeps in their research areas and have offered models concerning the importance of these water supplies during past periods of aridity, few scholars have attempted to actually measure the relationship between variability in spring discharge and cultural behavior.

Thomas (1983:69-71) has classified water sources in the Great Basin into two general types, point sources and linear sources, and has modeled expected settlement pattern responses to those source types. Springs, seeps, bedrock catchment basins (tinajas), playas and lakes would be examples of point sources; rivers, streams, and ephemeral washes represent linear sources. Although this categorization of water sources according to their linear extent is provocative, it fails to appreciate the potential variability in water supply and the effect of this variability on cultural adaptations. Bryan's (1925) early, but excellent account of water sources in the Papago country of southwestern Arizona provides a better model for evaluating the types of water that may be important in the Great Basin. For example, Pippin (1984, 1986) argues that ephemeral tinajas in the Yucca Mountain region of southern Nevada was crucial for the seasonal occupation of this area. Several Great Basin archaeologists have hypothesized that ancient artifacts found along paleochannels and lake shore margins reflect adaptations at times when surface waters were more abundant in the Great Basin. It is intriguing to consider, however, that many of the early archaeological sites in the Mojave Desert, including those that some have interpreted to reflect purely lacustrine adaptations, occur along river channels and playas that may have once held intermittent, interrupted or simply increased ephemeral, rather than perennial flow.

Price and Eakin (1974) provide a hydrologic map of the Great Basin which reflects current estimates of run-off and water budgets. In addition, the U.S. Geological Survey and various state agencies (Nevada Department of Conservation and Natural Resources, etc.) have conducted both quantitative and qualitative studies of current springs and ground water systems in various areas of the Great Basin (for example, Malmberg and Eakin 1962; Rush 1964; Thordarson and Robinson 1971; Winograd and Thordarson 1975). Mehringer and Warren (1976) provide a record of marsh and dune chronology at Ash Meadows, but point to the complexities of relating this chronology to spring discharge. Ongoing studies of hydrology and spring chemistry on the Nevada Test Site (Jacobson personal communication) may assist in the ranking of springs there according to their sensitivity to fluctuations in past climate (Reno and Pippin 1984:144).

Volcanism and Tectonic Activity

The study of volcanism and volcanic ash layers in the Great Basin is important in cultural resources studies for two major reasons. First, volcanic activity may have an important, if not a major role in climatic and environmental change. Increased aerosols extruded in the atmosphere during volcanism may initially have a minor warming effect followed by a net long-term cooling effect (Pollack et al. 1976) and some researchers feel volcanism may even trigger glaciation (Bray 1977, Porter 1981b). Regardless of its long term effects on climate, the deposition of volcanic ash over the landscape also may affect vegetation cover, animal communities and soil fertility as well as cultural adaptation (Blinman, Mehringer and Sheppard 1979; Grayson 1979; Grayson and Sheets 1979). Secondly, ash or tephra extruded from volcanoes may become deposited in archaeological sites and geological deposits and, if accurately dated at one locality, may

provide extremely valuable time markers by which to date other archaeological sites or geological deposits throughout a region (Self and Sparks 1981).

Sarna-Wojcicki, Champion and Davis (1983) have summarized information concerning the distribution, characteristics and age of Holocene volcanic activity and tephra deposits in and around the Great Basin, and Porter (1981b) has reviewed the use of tephrochronology in the Quaternary geology of the same area. Although there have been numerous, earlier volcanic eruptions from various provinces around the Great Basin (Bailey et al. 1976; Christiansen 1979; Davis 1978, 1985a; Izett and Wilcox 1982; Izett, Wilcox, Powers and Desborough 1970; Sarna-Wojcicki et al. 1984), silicic volcanism during the Holocene is restricted to three main areas: the Cascade Range, the Mono Craters-Long Valley areas of east-central California and the Salton Buttes area of southern California (Sarna-Wojcicki, Champion and Davis 1983, Fig. 5-1). Little is known concerning tephra layers, if any, produced by Holocene volcanism in the Salton Trough (Robinson, Elders and Muffler 1976), but Sarna-Wojcicki, Champion and Davis (1983, Table 5-1) list twelve major tephra layers from volcanoes (Mount St. Helens, Newberry, Crater Lake, Glacier Peak) in the Cascade Range that date between 13,000 years ago and A.D. 1980, and four major ashes from volcanoes (Panum Crater, Mono Craters, Inyo Craters) in east-central California that date between 2000 and 640 years ago.

The best known and most widespread of the Cascade tephras is the Mazama Ash extruded from what is now Crater Lake, Oregon, between 7000 and 6700 radiocarbon years ago (Bacon 1981). This ash covered most of the northern Great Basin and has been found as far south as Warm Springs, Nevada (Davis 1983b:82). As pointed out by Sarna-Wojcicki, Champion and Davis (1983:70), the widespread Mazama ash is not only useful chronologically, but also allows researchers to directly relate their deposits containing the ash to paleoenvironmental records also containing the tephra layer. The tephra from Newberry Volcano, dated between 1550 and 1720 B.P., is currently only known from Oregon, but could extend eastward into Idaho (Sherrod and MacLeod 1979). However, the usefulness of tephra layers is not necessarily related to widespread distribution. For example, localized tephras identified and dated in cores from the Steens Mountains have been used in establishing archaeological chronologies in the surrounding valleys (Aikens, Grayson and Mehringer 1982; Mehringer 1985; Mehringer and Wigand 1985a; Wigand 1985).

Several Holocene age tephras have been extruded from the Mono-Inyo Craters, but little is yet known concerning their age and distributions. Mehringer (1977, Fig. 8) illustrates five tephra layers in cores from Blake Lake, and Wood (1977; Wood and Brooks 1979) describes three layers of tephra, dating between 1120 and 650 B.P., in the Mono-Inyo area. Pippin (1980, 1982) reports three Mono-Inyo tephra units, dated between 1400 and 600 B.P., associated with archaeological sites in the Borealis Mine area near Hawthorne, and Hall (1983) describes several Mono-Inyo ash layers associated with archaeological sites in the Long Valley-Mono Basin region. Ashes from the Mono-Inyo Craters also have been found as far east as Hidden Cave (Davis 1985b:91-92) and the summit of Mount Jefferson (Thomas 1982a).

Geomorphic Processes, Pedology and Other Geoarchaeological Studies

Archaeologists and geologists have shared research interests, methods and data since the early 19th Century, but with the sharpening of theoretical thought during the last two decades archaeologists have begun to broaden their use of geological evidence. In the last decade, this application of geological evidence and methods to address archaeological problems has become known as geoarchaeology or archaeological geology depending on one's theoretical perspective (Butzer 1982; Davidson and Shackley 1976; Grayson 1983a; Rapp and Gifford 1985; Hassan 1979). Although geoarchaeological studies in the Great Basin have included such diverse topics as geochemical analyses of toolstone sources (Hughes 1984), x-ray diffraction analyses of pictograph pigments (Koski, McKee and Thomas 1973; Markman, Bard and Busby 1980) and paleomagnetic analyses of sediments (Thomas 1983:412-415; also see Wynn 1986), most have been focused on studying geomorphic processes and features. An understanding of the geomorphological context of archaeological sites is important not only because of its potential to provide information concerning chronology, environmental history and past patterns of land use, but also because geomorphic processes directly influence the nature of cultural remains at archaeological sites.

As pointed out by Knox (1983:37), surprisingly little is known concerning the responses of rivers to climatic changes in the Great Basin region and the effect of such responses on past cultural adaptations. Davis (1982b) has studied depositional history in the Humboldt Valley at Rye Patch Reservoir; Jennings and Sammons-Lohse (1981:11-17) have used archaeological evidence to examine Hunt's et al. (1953) model concerning the geological history of Bull Creek, and Currey (1980b) has examined the geomorphic history of Ivie Creek and of Sudden Shelter. But scenarios offered by Antevs (1948, 1955) over three decades ago have yet to be replaced by modern models. Some might argue that this reflects the fact that the cut-fill sequences so well studied in the American Southwest are absent in the Great Basin, but as emphasized by Mehringer (1977:129), even the most casual observations reveal obvious evidence of several cycles of erosion and deposition along drainages eminating from high lands. Changes in the hydrologic character of these drainages may not only reflect climatic change, but may have greatly influenced past patterns of cultural adaptation and the preservation of cultural resources. For example, the apparent lack of pre-Mazama cultural remains in the central Great Basin could be due to the fact that these remains are largely obscured by post-Mazama deposits (Davis 1983b:87; Thomas 1982b:161).

Archaeologists working in the Great Basin have long sought a means of dating artifacts found in the desert pavements of this region and have often pondered feasibility of using rock varnish for this purpose. Though scholars continue to disagree on whether desert varnish is physiochemical or biological, significant advances have been made during the last decades in our understanding of the processes responsible for rock varnish formation (Allen 1978; Dorn and Oberlander 1981, 1982; Elvidge and Collet 1981). Assuming a biological origin, Dorn (1983) has recently proposed that the ratio between mobile cations (Na, Mg, K, and Ca) and titanium in the varnish may be used for absolute dating. If so, then this technique

may be used to date geological surfaces as well as artifacts. Nevertheless, varnish formation may not be constant through time and may not necessarily initiate with rock deposition. Clearly, further research, particularly concerning the rates and processes of cation exchange in rock varnish and calibrations with well dated geological and archaeological deposits, is required before this technique can be considered a viable means of dating.

Biological Studies

Studies of Repeat Photography

Repeat photography is the technique of locating the site of a previous photograph and taking a new photograph of the same scene from the original camera position. A comparison between the new and old photographs can provide extremely valuable and accurate information concerning changes in vegetation and landforms, including those produced from past human activity. For example, using this technique Rogers (1982) has studied post-white settlement changes in plant communities throughout the central Great Basin; Ward and Greeley (1984) have estimated rates of headward and lateral erosion of yardangs at Rogers Lake; Foxworthy and Hill (1982) have recorded the effects of Mount St. Helens volcanism; and Graf (1983) has documented hydraulic changes in the streams from the Henry Mountains in Utah. The technique also has proven useful in studies of Euroamerican history in the Great Basin. Here, for example, Shamberger (1982) has examined the urban growth of Goldfield, Nevada between 1904 and 1907, and Hattori and McLane (1980) have relocated the alignment of the Pony Express route through Simpson Pass. Rogers, Malde and Turner (1984) have published an annotated and indexed bibliography of repeat photography that includes numerous references to studies in the Great Basin as well as sources of old landscape photographs (also see McQuaid 1982).

Pollen

Fossil pollen is important for cultural resources studies not only because it reflects the nature and distribution of past vegetation, but also because it provides a means through which archaeologists may evaluate how past peoples may have utilized that vegetation and how fluctuations in past environments may have influenced cultural adaptations. As pointed out by Mehringer (1977:134), the significance of pollen analyses in studies of Great Basin vegetational history has been recognized since Hansen's (1947) pioneering research. However, its potential for studying cultural patterns in the utilization of that vegetation has yet to be fully appreciated (Madsen 1982). The influence of cultural behavior on fossil pollen assemblages of archaeological sites, in fact, may mask fluctuations in past vegetation. For this reason, studies of fossil pollen that are focused on questions of past environmental change are best conducted at localities away from archaeological sites; whereas, pollen studies at archaeological sites are most applicable to questions regarding past cultural interaction with the environment.

Mehringer (1985) has recently reviewed the palynological evidence of environmental change in the northern Great Basin and interior Pacific Northwest. Records spanning full glacial (18,000 B.P.) and earlier times occur at Carp Lake, south-central Washington (Barnosky 1984, 1985); Ana River, south-central Oregon (Pippin and Davis, unpublished data); Lake Bonneville Basin in northwestern Utah (Madsen and Kay 1982; Mehringer 1977, Fig. 12; Spencer et al. 1984); Council Hall Cave and the Ruby Marshes in eastern Nevada (Thompson 1984); and at American Falls Lake Beds (Bright 1982), Grays Lake Marsh (Beiswenger, unpublished data), and Middle Butte Cave (Davis and Bright 1983; O. Davis 1984) in southeastern Idaho. Vegetation changes during the late glacial to Holocene period (18,000 to 10,000 B.P.) are reflected in the above records from Carp Lake, Lake Bonneville Basin, Ruby Marshes and Middle Butte Cave as well as in pollen records from Lake Cleveland (O. Davis 1981, 1984) and Swan Lake (Bright 1966) in southeastern Idaho, Curelom Cirque (Mehringer, Nash and Fuller 1971) and Snowbird Bog (Madsen and Currey 1979) in northwestern Idaho, and at Fish Lake in southeastern Oregon (Mehringer 1985, Fig. 12; Verosub and Mehringer 1984).

In addition to the records reported by Hansen (1947) and those mentioned above, Holocene age pollen records from southern Oregon also are now available from Wildhorse Lake and Diamond Pond (Mehringer 1985, Fig. 12; Mehringer and Wigand 1985b; Wigand 1985). In Idaho, additional Holocene age records occur at Bisonsweh Pond (Chatters 1982), Cub Lake (Baker 1983, Fig. 8.5), Murphey's Rockshelter (Henry 1984), and Rattlesnake Cave (Davis 1981; Bright and Davis 1982). Palynological studies at Crescent Spring (Mehringer 1985, Fig. 11), Remnant Cave (Hull 1976), Swallow Shelter (Dalley 1976), and Utah Lake (Bushman 1980) provide additional evidence of Holocene vegetational history in northwestern Utah. For northern Nevada, Madsen (1985) reports Holocene age pollen profiles from Potato Canyon Bog and from Mahala Creek; Thompson (1979, 1984; Thompson and Kautz 1983) has obtained Holocene age records from Council Hall Cave, Gatecliff Shelter, Ladder Cave, Mission Cross Bog, Pine Valley, Ruby Marshes, Smith Creek Cave, Triple T Shelter and Upper Dollar Lake; Byrne, Busby and Heizer (1979) have revisited Leonard Rockshelter; Kautz and Thomas (1972) conducted an analysis of fossil pollen from Toquima Cave and Gatecliff Shelter; and Wigand and Mehringer (1985) examined pollen and seeds from Holocene age sediments and coprolites at Hidden Cave.

Adam (1985, Table 1, Fig. 1) has assembled the published and unpublished pollen records from Quaternary age sediments in the eastern Sierra Nevada and California portion of the western Great Basin. Published records of Holocene age include those from the Auburn Dam site (Kilbourne 1978), Spring Garden Ravine (Matson 1972), Tahoe City (Adam 1973), Osgood Swamp (Adam 1967; Zauderer 1973), Ralston Ridge Bog (Sercelj and Adam 1975), Meyers Grade Marsh and Grass Lake (Dorland 1980; Dorland, Adam and Batchelder 1980), Soda Springs (Adam 1967), Black Lake (Mehringer 1977, Fig. 8), Chagoopa Plateau (Axelrod and Ting 1961), Alabama Hills (Axelrod and Ting 1961), Little Lake (Mehringer and Sheppard 1978), Searles Lake (Roosma 1958), and China Lake (Martin and Mehringer 1965).

As mentioned above, few Great Basin palynologists have used fossil pollen to address research questions other than those pertaining to the

nature of past environments. Nevertheless, palynological evidence may assist archaeologists in such tasks as the stratigraphic correlation and relative age placement of geological units, modeling seasonality of site occupation, modeling patterns of floral resource procurement and processing, assessing hypotheses concerning the functional context of features such as caches, and discerning possible areas of food preparation and/or ritual activities. Madsen and Lindsey (1979) used pollen from room fill and floors, metates, pottery vessels and hearths to establish patterns of prehistoric diet at Backhoe Village, west-central Utah. Here, as elsewhere in the northern Great Basin (Napton and Kelso 1969; Wigand and Mehringer 1985:116-118), these pollen studies confirm the prehistoric importance of cat-tail and other marsh resources, but also point to the use of Chenopods (like Allenrolfea occidentalis, Amaranthus sp., etc.) and other halophytic resources. Pollen washes from millingstones found at temporary camps in the rockshelters of Yucca Mountain, southern Nye County, Nevada, helped Pippin (1984) confirm Steward's (1938:96) statement that this area was used by historic aborigines for the procurement of spring resources like chia (Salvia columbarea).

Packrat Middens

Though still immature, our knowledge of past vegetation change in the Great Basin during the terminal Pleistocene and Holocene has increased dramatically with the development of packrat midden studies (Spaulding, Leopold and Van Devender 1983; Van Devender and Spaulding 1979; Wells 1976, 1983; Wells and Berger 1967; Wells and Jorgensen 1964). Packrats or woodrats (Neotoma spp.) gather a tremendous quantity and variety of plant remains from within a limited foraging range (30 to 100 meters) and accumulate these remains in their middens. These middens are commonly preserved in rockshelters and other protected environments in the arid Great Basin and, once radiocarbon dated, provide an extremely valuable inventory of past vegetation growing around that locality.

For example, pioneering analyses of packrat middens in the southern Great Basin have revealed that during the last glacial maximum vast portions of the Mojave Desert were inhabited by a pinyon-juniper woodland (Leskinen 1970; Mehringer 1967:183, 101; Van Devender and King 1971; Wells and Berger 1967; Wells and Jorgensen 1964). Subsequent analyses have indicated that these woodlands also differed considerably from present woodland plant associations (Mehringer and Warren 1976:125; Spaulding 1983a, 1983b; Spaulding, Leopold and Van Devender 1983:273-276, Fig. 14.7, Table 14.3). Hence, while some species such as juniper occurred more than 1000 m lower in elevation than their current limits, others were displaced less than 400 m or so and some, such as shadscale (Atriplex confertifolia) actually occurred much higher in elevation than they do today (Spaulding 1981; Van Devender and Spaulding 1979). Consequently, during glacial maximum conditions not only did certain plants grow at much different elevations than today, but more significantly, these plants formed communities (resource patches) for which there are no modern analogs. In fact, in certain areas, such as in the northern Mojave Desert of Eureka Valley, modern vegetation communities did not form until about 4000 years ago (Spaulding 1980:75-81).

Because plant macrofossils found in these ancient packrat middens are exceptionally well preserved and are frequently identifiable to the species and sometimes even subspecies level, they provide an analytical resolution unsurpassed by most other paleoenvironmental methods. Nevertheless, packrat midden analysis is a relatively new scientific discipline and still suffers from several methodological limitations. Perhaps the most significant of these limitations involves the meaningful quantification of plant remains in fossil middens. Several researchers have examined modern middens and have observed differences between the abundance of plant remains in the midden and the frequency of those plants in the local vegetation (Cole 1981:38; Spaulding 1983b:34-42), but systematic baseline studies focused at discerning the packrat's differential preference for certain plant species still need to be conducted (Vaughn 1980). Secondly, because packrat middens are most frequently preserved in rockshelters and rocky crevices, fossil assemblages in those middens often only reflect the past vegetation growing in those peculiar environments and regional environments may not be sampled (Jacobson and Bradshaw 1981). For example, the edaphic influences of rocky slopes and bedrock exposures may support plant species well below their normal elevational limits. Thompson (1984) has examined the notion that pollen samples from packrat middens may express this regional vegetation (King and Van Devender 1977:203), but concludes that midden pollen spectra appear to exhibit a more local signal than sediment surface spectra from the same site. Additionally, Thompson (1985) questions the notion that most middens form over several decades or even centuries and suggests that the lack of great variability in pollen spectra from the same midden may signify that they are created during relatively short periods of tim.

Packrat middens studies are best developed in the southern Great Basin where most research has been focused on discerning late Pleistocene environments. In the California portion of the Mojave Desert, late Pleistocene and early Holocene records have been reported for the Eureka Valley, Lucerne Valley, Marble Mountains, Ord Mountain, Turtle Mountains, Whipple Mountains, and Funeral Range (King 1976a, 1976b; King and Van Devender 1977; Spaulding 1980; Wells and Berger 1967). Across the border into southern Nevada, the Late Pleistocene records become even more comprehensive. In addition to Wells' (Wells and Berger 1967; Wells and Jorgensen 1964) pioneering investigations in the Spotted, Half Pint and Pintwater ranges, Spaulding (1981, 1983a, 1983b) has conducted extensive studies in the Eleana Range, Specter Range, Sheep Range and Spring Range; Mehringer (Mehringer and Ferguson 1969:284-287; Mehringer and Warren 1976:125) has reported middens from the Clark Mountains and Ash Meadows area and Leskinen (1970) has analyzed middens from the Newberry Mountains. Thompson and Mead (1982) summarize five middens from Potosi Mountain and Madsen (1976) describes seven middens from Meadow Valley Wash in southeastern Nevada. Finally, although south of the area typically included in the Great Basin, Phillips (1977) and Cole (1981) have performed detailed studies of packrat middens in the Grand Canyon of Arizona.

Elsewhere in Nevada, packrat midden studies have been conducted in the Toquima Range of central Nevada (Thompson and Hattori 1983), in the Snake, Schell, Confusion and Deep Creek ranges of east-central Nevada and west-central Utah (Thompson 1979, 1984; Thompson and Mead 1982; Wells 1983), and

in the Ruby Mountains and Winnemucca Lake area of northern Nevada (Hattori 1982; Thompson 1984; Thompson, Hattori and Tuohy 1984). Mehringer and Wigand (1985b, 1986) and Wigand (1985) have recorded middens from both the Diamond Pond locality in the Steens Mountains of south-central Oregon and the Lava Beds National Monument in northeastern California. Siegal (1983) has studied the hydrogen isotope content of wood cellulose in Thompson's (1984) packrat middens in the Snake Range and has used these data to infer past changes in mean annual temperatures during the Holocene.

The packrat midden records from the central and northern Great Basin contain data directly pertinent to hypotheses concerning the spread of pygmy conifer woodlands through the Great Basin following deglaciation (Madsen and Berry 1975). Thompson and Hattori (1983:163-167) review the Holocene records containing pinyon pine (Pinus monophylla) and conclude that pinyon, although present in the southern Great Basin throughout the Late Pleistocene, did not reach the central Great Basin until about 6000 years ago and may not have occupied its current range in northeastern Nevada until about 4000 B.P. Utah juniper (Juniperus osteosperma), on the other hand, appears to have reached its northernmost distribution in the Pryor Mountains of Montana by 10,000 B.P. (Mead 1982). Mehringer and Wigand (1985b:7, 1986) propose that western Juniper (Juniperus occidentalis) was in northeastern California by at least 5000 B.P. and that between 4000 and 2000 years ago may have exceeded its current distribution in eastern Oregon.

Paleofaunas

The remains of ancient animals found in geological deposits and archaeological sites may provide direct evidence of paleoclimate, past fluctuations in faunal resource availability, and cultural patterns of resource exploitation. Grayson (1983b:99) emphasizes that cultural resources, particularly caves and rockshelters, have provided unique and extremely valuable data concerning late Pleistocene and Holocene zoogeography and vertebrate ecology in the Great Basin. Yet, he (Grayson 1982:82) explains that much is still to be learned concerning Great Basin Quaternary vertebrate paleontology when compared to our knowledge from other areas in North America (Lundelius et al. 1983). Occurrences of Pleistocene fauna have been published for the Fossil Lake and Connley Caves localities in south central Oregon (Allison 1966; Cope 1878; Grayson 1977; Howe and Martin 1977); Smith Creek Canyon and Mineral Hill Cave in eastern Nevada (McGuire 1980; Miller 1979); Tule Springs, Gypsum Cave and Glendale beaver ponds in southern Nevada (Mawby 1967); China Lake Manix Lake, Whipple Mountains and vicinity, and Schuiling, Kokoweef and Mescal caves in southeastern California (Brattstrom 1958; Downs, Howard, Clements and Smith 1959; Fortsch 1978; Howard 1955; Kurten and Anderson 1980; Van Devender and Mead 1978); Wilson Butte Cave, Dam and Rainbow Beach localities in southern Idaho (Barton 1975; Gruhn 1961; McDonald and Anderson 1975) and Silver Creek, City Creek Canyon, MONROC Gravel Pit and Sandy Mammoth sites in the Bonneville Basin in northern Utah (Madsen, Currey and Madsen 1976; Miller 1976; Nelson and Madsen 1980). Extinct large mammals contained in these Pleistocene assemblages include sloths (Nothrotheriops, Megalonyx, Glossotherium), bears (Arctodus), cats (Acinonyx, Smilodon), elephants (Mammuthus), horses (Equus), peccaries (Platygonus), camels (Camelops,

Hemiauchenia), antelope (Capromeryx, Tetrameryx) and cattle (Euceratherium, Bottherium, Symbos). As emphasized by Mehringer (1977:146), the apparent sudden and massive extinction of these megafauna is perhaps the most important biological event to have occurred during the late Pleistocene (Martin and Klein 1984).

Holocene faunas have been retrieved from archaeological sites in almost all areas of the Great Basin. Grayson (1982:87-92) has used these data to examine Brown's (1971, 1978) hypothesis that the modern distribution of boreal mammals in the Great Basin is due to initial Pleistocene colonization followed by the extinction of geographically intermediate populations. Grayson (1981, 1982:92) contends that the chronology of local extinctions within these Pleistocene relicts was influenced by the size and distribution of suitable habitat, the initial size of the population, local climatic change and, possibly, human predation. Mammalian isolates that are important in testing these hypotheses include the pika, least chipmunk, yellow pine chipmunk, Panamint chipmunk, Uinta chipmunk, Richardson's ground squirrel, golden-mantled ground squirrel, Townsend's pocket gopher, Northern pocket gopher, dark kangaroo mouse, pale kangaroo mouse, Panamint kangaroo rat, southern grasshopper mouse, montane vole and California vole (Grayson 1982, Table 3).

Significant advances have been made in the methodological aspects of faunal analyses during the last decade (Beyrensmeyer and Hill 1980; Grayson 1984; Lyman 1982; Shipman 1981; Stahl 1982; Watson 1979). These advances include both consideration of how faunal remains are incorporated and modified through time in the fossil (archaeological) record and the problems associated with the meaningful quantification and interpretation of faunal data. Although these methodological treatments generally identify more problems than viable solutions to questions of taphonomy and quantification, this type of soul searching is not only badly needed, but is destined to bridge the gap between theoretical models and the empirical evidence needed to support those models.

Several researchers have noted changes in the abundance of certain taxa in the faunal records from Great Basin archaeological sites and have related these changes to various causes including sampling error, climatic change, patterns of cultural exploitation, and site seasonality. For example, Grayson (1979; 1982:93-94) proposes that the mid-Holocene decrease in pygmy cottontails (Sylvilagus idahoensis) at Connley Caves, Gatecliff Shelter, the Wasden Site and other places may reflect decreased effective precipitation. Thomas (1970) has noted that the remains of deer (Odocoileus spp.) are more common in Great Basin archaeological sites after about 1000 years ago than before and suggests this shift in resource exploitation could be due to environmental factors. Similarly, Pippin (1979) has observed that bighorn sheep are apparently more common in Great Basin archaeological sites after 4000 B.P. than before, but that bighorn appears to have been commonly exploited throughout the Holocene. Grayson (1982:95-96), however, calls for additional research pertaining to whether these apparent fluctuations in Artidactyl remains are due to changes in human behavior or to changes in resource abundance.

Conclusions and Recommendations

The following recommendations are intended to represent possible and potentially productive avenues of viewing and studying the relationship between archaeological sites and their natural context. However, these recommendations should not be considered either completely adequate for or necessarily applicable to any one particular cultural resources project.

From a site-specific perspective, studies of the relationship between archaeological sites and their natural environment might include the following:

1. The study of the geological processes that may have influenced the way that a particular archaeological site was incorporated into or placed on geological sediments. Also, the geological processes that may have been responsible for modifying the nature of that archaeological site once it was incorporated into or deposited on those sediments.

2. The utilization of geochronological or other stratigraphic and geochemical data for the absolute or relative dating of archaeological sites. Conversely, the use or evaluation of the potential for the use of archaeological sites in the dating of geological deposits, surfaces or landforms should also be considered.

3. The employment of palynological and/or other micro- and macrobotanical studies (flotation analyses, phytolith or plant opal analyses, coprolite analyses, $^{30}C/^{12}C$ ratios, etc.) in determining the cultural procurement, utilization, cultivation, processing and/or storage of botanical resources. Also, the study of how that utilization, cultivation, processing and/or storage may have influenced both cultural development and the natural environment.

4. The use of osteological, taphonomic, chemical, and other zooarchaeological studies focused at discerning cultural procurement, utilization, domestication, processing and/or storage of faunal resources. Also, the study of how that procurement, utilization, domestication, processing and/or storage may have influenced both cultural development and the natural environment.

5. The employment of both physical and chemical studies (petrological, mineralogical, metallurgical, geochemical, biochemical, etc.) focused on the identification and characterization (finger printing) of raw materials used in artifact manufacture. Also, the study of how those raw materials or their availability may have influenced aspects of cultural development (production technologies, site location, etc.).

From a regional perspective, studies of the natural environment and its relationship to archaeological sites might include the following:

1. Studies of the relationship between a group of cultural resources and the regional landscape, that address questions of settlement patterns, seasonality, resource availability, potential depositional environments, stratigraphic associations, etc.

2. Palynological and other micro- and macrobotanical studies (packrat midden analyses, etc.) focused on determining the distribution and abundance of botanical resources and changes in the composition and associations of those resources through time within a region surrounding archaeological sites. It is important to note here that sampling localities utilized by these studies may, and probably should, include localities away from known archaeological sites.

3. Osteological, taphonomic and other zoo-archaeological studies focused on determining the distribution and abundance of faunal resources and changes in the composition and associations of those resources through time within a region surrounding archaeological sites. Again, these studies may, and probably should, include sampling localities away from known archaeological sites.

4. Hydrological, geochemical, and geological studies focused on characterizing the nature of, and past changes in the abundance and distribution of, water resources within a region surrounding known archaeological sites.

5. Physical and chemical studies focused on characterizing (finger printing, etc.) the nature of, and past changes in the distribution and abundance of, lithic resources available in a region surrounding known archaeological sites and the use of these studies in determining past cultural patterns of exchange, transhumance, etc.

6. Geochronological, tephrochronological, geochemical, and other studies focused on the dating and characterization of stratigraphic units and landforms within a region that contains archaeological sites.

7. Dendroclimatological, meterological, climatic modeling, geological, botanical and zoological studies focused on characterizing the nature of and past changes in climatic patterns (precipitation patterns, growing seasons, rates of evaporation, variability in temperatures, wind conditions, etc.) in a region surrounding known archaeological sites.

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PART III

CONDUCT OF CULTURAL RESOURCE MANAGEMENT IN THE REGIONAL CONTEXT

RESEARCH DESIGN

by

Donald Hardesty

The Airlie House Report identifies four key elements in a research design (McGimsey and Davis 1977:72): (1) a statement of perspective; (2) a discussion of the existing data base; (3) research goals and their rationale; and (4) a research strategy. Cultural Resource Management research in the Great Basin generally follows the same structure of inquiry. The Airlie House Report, however, did not consider the interaction between research design and the activities needed to comply with the provisions of Section 106 of the National Historic Preservation Act, Executive Order 11593, and the regulations of the Advisory Council on Historic Preservation. Such compliance requirements include review of research proposals to determine, among other things, if any kind of data recovery plan is appropriate. Accordingly, a proposal should show that archaeological properties in the research area have been identified accurately, that the properties are significant by National Register criteria, that they are threatened, that they cannot be reasonably preserved in place, and that the proposed research would result in a determination of no adverse effect (Advisory Council on Historic Preservation 1980). The proposal must show as well that the research is consistent with any regional, state, or local historic preservation plans that may be in effect. All of this is in addition to the key elements of the research design discussed below.

Perspective

The Airlie House Report considers that a statement of theoretical perspective is an essential part of the research design (page 72). Anthropology is the explanatory framework proposed by the report, giving a behavioral orientation to the evaluation of significance. In this, most research designs coming out of Great Basin CRM are in agreement. As is true of anthropology in general, however, no single explanatory paradigm controls the conduct of archaeological research in the Great Basin. At the same time, some elements are common. Virtually every statement of theoretical perspective is grounded in Stewardian cultural ecology interpreted within a systems framework (e.g., Woodward-Clyde Consultants 1980). The concepts of cultural adaptation and adaptive strategies, environmental and cultural systems, are pervasive. Overall, the explanatory efforts are directed toward understanding "how things worked" in the past--settlement and subsistence systems, lithic technology, interaction spheres, and the like. Time-bound, historical explanation with extensive use of ethnographic models is the prevailing approach, although some attention is being given to time-free, positivistic explanation of the cultural processes involved (e.g., Bettinger and Baumhoff 1982; Busby and Kobori 1980; Hardesty 1980-81; O'Connell et al. 1982).

Explanations of cultural change are also incorporated into Great Basin research designs. The perspective is also typically Stewardian in looking at specific interactions between culture and environment but is less

systemic than that used in studies of how things work. Prime movers are commonly referred to. Environmental change remains the favorite, although the idea of a widespread Altithermal-forced change is no longer acceptable (Aikens 1978:77ff). The mechanism of environmentally-induced changes usually is not stipulated, however, except in the few instances where the principles of evolutionary ecology have been invoked (e.g., Bettinger and Baumhoff 1982; O'Connell et al. 1982).

Problem Domains

From these research perspectives should be defined a set of problem domains stipulating the questions that should be asked. The problem domains most often found in Great Basin CRM research designs are centered upon the behavior, chronology, and environmental context of hunters and gatherers. Such domains include paleoenvironmental reconstruction, demography, ethnicity and cultural origins, variability and change in settlement-subsistence systems, belief systems and ideology, chronology, lithic technology, interaction spheres (including trade and exchange networks), and patterns of long-term cultural continuity and change (e.g., Elston 1979; Lyneis 1982; Madsen and O'Connell 1982; Woodward-Clyde Consultants 1980).

Most of the questions being asked continue to be, and probably necessarily so, the journalistic ones needed to establish the temporal, spatial, and behavioral boundaries of Great Basin cultural history--who, what, where, and when. But more and more CRM research designs are focused upon questions about cultural processes bringing about variability and change, especially the conditions under which variability and change in settlement-subsistence systems take place (e.g., Madsen and O'Connell 1982; Thomas 1983; Bettinger and Baumhoff 1982; Woodward-Clyde Consultants 1980).

In addition to these hunter-gatherer problem domains are the questions being asked about prehistoric farmers and the historic period in the Great Basin. The former are mostly related to the nature of Anasazi and Fremont settlement-subsistence systems and the reasons for their appearance and disappearance. Historic problem domains are split between hunters and gatherers and the expansion of American Civilization into the Great Basin. Research questions that deal specifically with hunters and gatherers in the historic period, above and beyond those identified above, are mostly about cultural contact--especially patterns of acculturation, extinction, and survival resulting from American colonization (e.g., Clewlow et al. 1980). The problem domains surrounding American Civilization studies include patterns of expansion and colonization (e.g., Mormon colonization, the pony express, and military installations), the Overseas Chinese, variability and change on the mining frontier, and urbanism (e.g., Lyneis 1982; Hardesty 1980-81; Hattori et al. 1979; Ostrogorsky 1980; Berge 1980).

Research Strategy

The algorithm for achieving the goals identified above should be included in the research design as well, according to the Airlie House Report. For our purposes, two kinds of strategies for conducting CRM research in the Great Basin can be recognized: (1) inventory-oriented, and

(2) significance-oriented. Inventory strategies are intended to describe the locations and kinds of existing and expected cultural resources in a region. They achieve this goal using methods ranging from literature searches, to 100% surveys, to predictive models based upon samples. Cultural Resource Overviews of the type stipulated by Executive Order 11593 and prepared by such government agencies as the Bureau of Land Management and the Forest Service use this strategy (e.g., Busby et al. 1979; James and Singer 1980; Minor et al. 1979; Smith et al. 1983).

Significance strategies link key research and management questions to the answers and public values that are potentially contained within historical and archaeological sites. Both scientific and public significance are included. The determination of eligibility for listing on the National Register of Historic Places is a key purpose of significance strategies. Since determining significance by National Register criteria requires answers to questions about information content, representativeness, and the association of sites with historically unique events and people, and since "rareness" increases eligibility, significance strategies do not usually incorporate the building of predictive models as a methodological step.

A management-oriented research strategy that combines both inventory and significance strategies is the Resource Planning and Protection Process (RP-3) developed by the State Plans and Grants Division of the now-defunct Heritage Conservation and Recreation Service (HCRS 1980). In the RP-3 strategy, existing knowledge about a region is first identified and then used to organize the region into "study units." Each study unit has a geographical, chronological, and thematic distinctiveness. Predictive Models of the cultural resources expected in each study unit are then developed. The data requirements for testing the accuracy of each model are identified and used as guidelines for the collection of new information, which can then be used to revise the model. Next is significance determination. Key research and management goals are formulated for each study unit and used to determine the relative significance of historical and archaeological sites either existing or expected in the region. Protection and management priorities are based upon this assessment. This approach to research design strategy is illustrated in the HCRS/HAER Comstock Project in the Virginia City National Landmark District in Nevada (HCRS 1980) and in the Archaeological Element of the Nevada Historic Preservation Plan (Lyneis 1982).

All research strategies, whether used for inventory or significance or both, should have a common set of elements. These include arguments that link questions and answers (such as middle-range theory, models, and hypotheses); methods of data recovery (such as sampling techniques); and ways of determining the sufficiency of existing and new data for answering questions (including estimates of uncertainty).

Linking Arguments

Perhaps the most important logical step in any research strategy is finding proper linkages between theories of behavior and the archaeological record (Binford 1977:2-10; Thomas 1983:17ff). Great Basin CRM studies often neglect stipulating how this logical leap is made. The most common

efforts at middle-range arguments are models of procurement systems of hunters and gatherers. Such models are usually based upon ethnographic and ethnohistoric information about particular groups, such as the Washo (Elston 1979) or the Western Shoshone (Thomas 1983); a few are based upon global generalizations (e.g., Woodward-Clyde Consultants 1980). From these models and similar linking devices testable hypotheses with stipulated data requirements are formulated.

Data Recovery

The second step in a research strategy is to stipulate how questions stated in the form of hypotheses can be answered with CRM data. Sampling design is important. Probabilistic sampling strategies are commonly used for large scale inventory surveys, such as the Class 2 surveys on BLM lands or surveys of military reservations (e.g., Bergin 1979; HDR Sciences 1980). Smaller scale, intensive surveys, however, generally use some form of systematic sampling (Rusco 1982:55).

Most sampling problems in Great Basin CRM research originate either in selection of scale or sampling strata. The scale of the study arena is often quite variable. Many cultural properties of the historic period in the Great Basin, for example, can be understood only within the context of urban and industrial processes working on a world scale. Thus, archaeological patterns of historic mining districts are best modeled as originating in national and world systems (e.g., Hardesty and Hattori 1982; Teague and Shenk 1977). Market prices of precious metals, industrial technologies, and supply networks operate at these large scales and directly affect patterns of culture change and cycles of abandonment and reoccupation of mining districts.

The problems of stratification are illustrated by the data collection strategy proposed in the draft environmental impact statement (DEIS) of the now-defunct Nevada/Utah basing plan for the Air Force's MX missile system. In this plan sampling units used for field surveys are defined either as point or linear water sources such as springs, lakes, and streams, or as randomly selected areas within the unwatered land that remains (HDR Sciences 1980:112-114). But historic land use patterns cannot be accurately sampled in this way (see the State of Nevada official response to the MX DEIS 1981). Where historic sites occur is also likely to be structured by transportation corridors such as roads and railroads, population centers, forts and other military installations, mineral-bearing faults and placers, and legally-defined land grants. For this reason, the sampling process must first identify these "gravity centers" and then define sampling strata around them. The problem with the original sampling design is, of course, simply the failure to take into consideration the large pool of existing data in the form of written documents that is available for historic sites.

Data Sufficiency

Perhaps the greatest difficulty in the research designs developed in Great Basin CRM today is the insufficiency of existing data for testing hypotheses. One of the foremost data sufficiency problems is the uneven

distribution of surveys and excavations throughout the region. Because CRM research is sponsor-oriented rather than systematic, data "clusters" with large gaps are the rule. Such clusters in the Great Basin include the oil and gas overthrust belt of eastern Nevada and Utah, the major river systems where hydroelectric projects are centered, the public timber lands, mining districts, and population centers (Hardesty et al. in press). Among other things, the uneven coverage makes it nearly impossible to test correlational hypotheses.

A second data sufficiency problem is the small amount of existing information about paleoenvironments. Adequate environmental reconstructions have been attempted for only a few widely scattered areas; yet cultural ecology, the prevailing explanatory framework, demands that such data exist (see Pippin, this volume).

Another critical problem in testing hypotheses arises from the failure to adequately integrate data coming from surveys for inventory purposes with the more detailed data from the excavation of particular sites (Hardesty et al. in press). Most CRM work in the region has been oriented toward surveys and literature searches of existing data simply because most of the area is public land subject to Executive Order 11593. The overall effect has been to accumulate a lot of information about site locations and the development of rather elaborate site taxonomies based only upon surface manifestations. Good diachronic and functional data, which can come only from the excavation of buried sites, are randomly scattered and usually do not occur in those places with the best surface survey information. Better linkages between the two kinds of CRM data are needed.

Data Retrieval

The Airlie House Report recommends that methods for the effective dissemination of data be incorporated into the research design (McGimsey and Davis 1977:73). Readily available information about cultural resources that can be used to make rapid decisions is the key to efficient compliance work. To what extent does CRM in the Great Basin meet this requirement? Most of the CRM reports are unpublished manuscripts printed in a very few copies and available only in a few regional repositories (e.g., the Nevada State Museum, the Idaho State Historical Society, and the Utah Division of State History). Site records are similarly limited. In most cases data retrieval requires visiting the repository, searching for appropriate reports or site files, and scanning these records on the spot. Such a process is expensive and time-consuming, greatly hindering compliance activities. A major effort is being made to alleviate this problem through the development and implementation of the Intermountain Antiquities Computer System (IMACS). Administered by the University of Utah, IMACS makes it possible to rapidly access site records throughout the Great Basin (see Lichty, this volume).

Historical Research Needs

Several problems currently plague historic sites research in the Great Basin. These may be grouped into two categories: research design and implementation. Research design problems originate first of all in

inadequate familiarity with the key research and interpretive questions needed to evaluate the significance of historic sites. Most archaeologists engaging in historic sites research have been trained in prehistory and anthropology rather than in American history, folklore, or architecture. Accordingly, the archaeologist is all too often unaware of the relevant literature in history that identifies critical considerations needed to develop research designs and to evaluate the significance of historic sites. The same problem exists as well with the identification of sources of information that can be used to answer research questions. This problem can be ameliorated by more use of specialists in American history and related disciplines. At present, however, few CRM projects provide for adequate funding of this kind, although prehistoric projects routinely support specialists such as geologists, palynologists, and the like.

If the archaeology of historical sites needs more input from historians, it is equally true that historians engaged in Great Basin CRM work are generally not sufficiently versed in archaeology to make the needed linkages between history and on-the-ground cultural resources. For example, historians have been employed on occasion to write CRM overviews of the historic period (e.g., Bowers and Muessig 1982; Greene and Latschar 1980). Such overviews are summaries of important historical events, people, and places organized by themes or time periods or both. Unfortunately, little information is provided about the material context of the history above and beyond listing where key sites are situated and their historic names. What archaeologically visible site patterns or intra-site artifact distributions have meaning to historians? The linkage between material culture and historical interpretation is emphasized by some American historians (e.g. Schlereth 1980) but those working in Great Basin CRM have not taken this direction. Ideally, historians working from the perspective of material culture could develop the critical area of "middle range theory" in historic sites archaeology.

Implementation

Problems of implementation include both personnel and task interfacing. Above and beyond the problem of not using trained historians or related specialists in historic sites archaeology, discussed above, is the failure to use SOPA-certified historical archaeologists. The most common practice is to treat prehistoric and historic sites as the same thing for purposes of reviewing personnel qualifications. Yet it is quite clear that research questions, methods, and the data base are sufficiently unique to justify special training--indeed, there are doctoral specialties in historic archaeology (e.g., the University of Pennsylvania). SOPA certification in historical archaeology was developed for this reason. The strengthening of historic sites archaeology in the Great Basin depends upon the use of this standard.

A second problem of implementation is inadequate communication among specialists on all phases of research on historic sites. If specialists are used, their contributions are most likely to appear as appendices rather than being fully integrated into the report. Historians and archaeologists should interact to identify research questions, the strategy to be used to answer the questions, data collection methods, data analysis,

and interpretation. Interdisciplinary cooperation is essential in the future to most effectively manage historic sites and to circumvent increasing criticism from historians about what archaeologists do.

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SURVEY AND COLLECTION POLICIES

by

Colin I. Busby

Policies concerned with the collection and/or non-collection of cultural materials during surface surveys have generally been set on an informal rather than formal basis among the federal entities concerned with the management of cultural resources. Collection/no collection parameters have often been left to the judgment/discretion of the archaeologist, who would follow a personal philosophy which could be no collection, collection of only "diagnostics," collection of a "sample" of both diagnostics and non-diagnostics, total collection, or whatever. Each survey, and often each site, has been dealt with as it unfolded, with little consistency except that brought about by the personal views of the archaeologist involved.

Agency collection/no collection policies are now being developed at the regional and area level to bring some consistency to this situation. The Bureau of Land Management's Nevada State Office has produced a detailed collection policy statement for both small and large sites (BLM Nevada 1982). Each site is placed in one of three categories: "nondescript sites," "sites with diagnostics and/or spatial patterning," and "sites with depth potential and/or architectural or other features." Collection policy depends on where a site falls within the classification scheme. Communication and cooperation with the Nevada SHPO are emphasized throughout the process. The policy appears flexible and broad enough to meet almost all field situations and research needs. The policy has met with wide acceptance, becoming almost a de facto standard, and has been adopted by other organizations in the Great Basin (R. Hanes, personal communication, 1984).

The Bureau of Land Management, Utah also has a flexible collection policy although it is not quite as detailed as that of Nevada. Artifacts may be collected if:

> ". . . in the opinion of the cultural resource professional, they are subject to unauthorized removal, are unique, or cannot be readily identified in the field. If artifacts are collected, justification rationale, plus the method and nature of any collections (e.g., structured versus non-structured, biased versus non-biased) shall be included in the report. Artifact provenience control shall be established and exercised. Caution should be exercised as any collection will necessitate a more detailed assemblage analysis (Bureau of Land Management, Utah 1984).

The Forest Service, Region 4, has a similar policy and requirements for recordation (U.S. Forest Service, Intermountain Region 1985). Forest Service personnel in Nevada generally follow the Nevada BLM policy coupled with SHPO consultation (A. Turner, personal communication, 1985).

Conflicting collection/no collection philosophies are often reflected in the Requests for Proposal issued by the various agencies for their survey work, although with the implementation of "collection policies" and inter-agency information sharing this is slowly changing. For example, two different agencies in the same geographic area may have dissimilar "policies"; that is, one may encourage collection on sites discovered during the work while the other may actively discourage or forbid collection during the survey, preferring to have collection treated as one of several "mitigation" measures that should be considered in the management process.

In brief, instead of a single, uniform, central federal policy for all agencies, a multitude of decentralized policies administered at the region/area level on an agency by agency basis seems to have evolved. While some uniformity may be present at this level among different agencies, it is important to recognize that each region/area sets and interprets a policy independent of a central government policy.

The lack of a national policy for guidance has disturbing implications for the resource base. The provisions of the Archaeological Resource Protection Act (ARPA) appear to allow a federal land manager the flexibility to set and implement an independent policy providing that it doesn't conflict with national directives. This, by extension, allows the manager to develop certain CRM policies independently (i.e., collection/no collection), in consultation with professional staff, for there is no national policy available for guidance on this issue. In practice, this means that a cultural resources manager can develop certain policies based on personal beliefs providing that the land manager is in agreement. It is clear that a uniform national policy would be in the best interest of both the profession and the land manager in avoiding unnecessary conflict, setting common procedures and preserving the resource base.

William Butler's (1979:795-799) statement on the "No-Collection Strategy in Archaeology" is still relevant today and represents the best, if not the only specific review, of the conflict of ethics and values for archaeologists who must choose between collection and no-collection. Butler's thesis (1979:795) is that archaeologists who do not make artifact collections from sites are not practicing a conservation ethic, do not assist their sponsors in complying with the cultural resource laws and do not make a contribution to the discipline. Butler (1979:795-798) examines arguments for and against the no-collection strategy from the perspectives of site integrity, artifact analysis, pothunting and curation.

Site integrity and removal of a site from consideration for the National Register are not affected by a well-controlled and accurately recorded surface collection. Disturbed sites can often yield important information on past activities from a controlled surface collection. Future mitigation actions are not jeopardized by collection if it is guided by an explicit research design and replicable controls. National Register significance is based on Criterion D (likely to yield significant information) and must be evaluated in terms of both regional and theoretical concerns.

Field artifact analysis, often presented as an alternative to collection and subsequent laboratory analysis, is often not technically adequate due to time constraints. It relies on the varying levels of sophistication of individual survey teams, and may not consider the questions of future researchers. Butler (1979:796-797) notes, ". . . the failure to make sound representative collections of all classes of artifacts present on a site destroys our ability to answer future research questions, unless, as many naively assume, those artifacts will be found on the site at some future time."

Illegal collecting may eliminate part of the data base if it is not gathered by the archaeologist; the only record often consists of a single visit by a professional.

An archaeological site is a non-renewable resource and each has the potential to contribute to answering anthropological and archaeological questions. A site's potential for research may be severely limited or precluded unless it is accurately recorded and a representative sample collection made. Sites can be destroyed during a project or adversely affected by natural processes. Collection is one of the procedures that can be used to develop the research potential of a site.

Curation is a continuing problem for cultural resource management. While a no-collection policy effectively avoids the immediate problem of curation of both artifacts and their records, it can also be viewed as avoiding government curation responsibilities embodied in law (i.e., the Antiquities Act). Butler (1979:797-798) argues that the federal government is responsible for protecting and preserving cultural property found on Federal lands for the American people as well as protecting the information value of archaeological collections. Collections not made are not protected and archaeologists should therefore make collections to be curated for the people of the United States and for future archaeologists to examine. "We may have but one opportunity to maximize a site's information potential and to preserve as much of that information potential as possible" (Butler 1979:798).

Butler (1979:798) concludes that a "no-collection" strategy has limited present benefits and negligible future value. His conclusion that a no-collection policy effectively short-changes future generations must be seriously reviewed by the profession. Collection has the potential for deriving useful data from sites if completed under controlled, replicable conditions and guided by an explicit research design. A uniform and comprehensive "collections" policy must be developed by the government and the archaeological profession to replace the present hodge-podge of local and often conflicting policies that have been designed to fill the current vacuum. We can only benefit.

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EXCAVATION AND ANALYSIS OF NATIVE AMERICAN BURIALS

by

Colin I. Busby

A national statement offering guidance to the profession on the sensitive and difficult issue of the excavation and study of Native American burials is now in the process of being developed by the Society for American Archaeology. A series of individual views from archaeologists, physical anthropologists, Native American elders, and others, were presented at the 1986 annual meeting of the SAA, and a statement of principles developed by the society was subsequently presented at the meeting. A published account of these efforts is forthcoming.

The excavation of aboriginal burials is a particularly sensitive issue to archaeologists, physical anthropologists, Native Americans and curating institutions (Cheek and Keel 1984). All parties have much to gain and lose in terms of the present and future data base and cultural heritage. A policy is badly needed on the national level to provide basic guidance for the archaeological profession before local and state policies totally preempt the matter, a situation which is occurring in California (see Meighan 1984). Many of the state and local policies are centered on the ideal of religious freedom and do not consider the scientific importance of aboriginal burials to either prehistory or Native American cultural heritage. The SAA, recognizing the need for a national-level guiding policy, has just produced a statement on aboriginal burial excavation. The American Association of Physical Anthropologists, whose research interests and potential data base are directly affected by the issue, has also addressed the problem (AAPA 1982). Curating institutions and repositories have also recognized the importance of their human skeletal collections and the need for specific policies (Myers 1984; Tymchuk 1984; Buikstra 1983; F. Norick, personal communication, 1984).

Winter's (1980) general article discussing the development of productive relationships between archaeologists and Native Americans is still the best summary concerned with sources of conflict and suggestions for their resolution that has been written in the past several years. His presentation should be required reading.

On the federal level, communication with Indian groups is mandated by federal regulations incorporated in the Archaeological Resources Protection Act of 1979 (See DOI, Federal Register 49(4)). This regulation gives land managers a mechanism to initiate contact with Indian tribes, notifying them of possible conflicts arising from permit applications (i.e., to conduct archaeological work on federal lands). Land managers may request and respond to requests for consultation, and may incorporate in the terms and conditions of permits any mitigation or avoidance measures adopted as a result of consultation. This includes communication and mitigation measures in regard to human burials, although aboriginal burials and their associated grave goods are considered federal property and are not to be released for reburial (D. Manual, personal communication, 1984).

Guidelines pertaining to archaeological human remains on federal lands are presented in a National Parks Memorandum (9/22/83, Departmental Consulting Archaeologist) which offers specific advice and guidance to federal land managers.

A similar notification/consultation measure is incorporated in the Oregon Revised Statutes (ORS 358.950 When notice to Indian tribe required; report) for notifying Indian tribes when archaeological research will be conducted on both private and public (state) lands. Informal cooperation on burials is maintained between the State Historic Preservation Officer and federal archaeologists. Federal policy follows ARPA (consultation) and is handled on a case by case basis. California does not have a similar statute but does require, when an aboriginal burial is encountered either on private or public land, that the County Coroner contact the Native American Heritage Commission to assist in the disposition of the remains (SB 292). Memoranda of agreement are currently being drafted or are under review by the Native American Heritage Commission and various federal agencies to outline procedures for dealing with human skeletal remains found on Federal lands (L. Allen, personal communication, 1984).

Idaho has a "grave protection act" similar to that for Oregon. The law was originally developed to prosecute vandalism but also regulates archaeologists in regard to aboriginal burials. The law applies to both historic and prehistoric human remains and has sections on desecration, unlawful removal, prohibited acts and permitted acts. Section 27-503 allows a professional archaeologist to excavate and remove material objects and human remains for subsequent reinterment following scientific study, only if the remains are endangered. Notification and permission must be obtained from the director of the State Historical Society and the appropriate Indian tribe. Communication is mandatory with the Indian group although a "no response" to the request is interpreted as permission to proceed. Civil action and damages are allowed for violations of the law (see State of Idaho, Senate Bill No. 1338, 47th Legislature, Second Regular Session, 1984). Again, cooperation between state and federal archaeologists is informal (T. Green, personal communication, 1984).

The Nevada Division of Historic Preservation and Archaeology policy on human skeletal remains is incorporated into the State Historic Preservation Plan. It requires that primary consideration be given to the in-place preservation of historic and prehistoric burials. In addition, the division requires that all appropriate individuals, groups (including tribal councils), and agencies be contacted and given an opportunity to comment on the management of this resource. Specific procedures are outlined in the policy, and special conditions are included on all state Antiquities Permits to comply with the policy. The policy is valid only for state land and while not applicable to federally managed lands, federal archaeologists and managers coordinate with the Nevada SHPO in regard to human skeletal remains (A. Becker, personal communication, 1985; R. Hanes, personal communication, 1984).

Utah does not currently have a state policy although Federal and state cooperation (through the State Archaeologist) is present. Current BLM policy is to handle human skeletal remains on a case by case basis using

available federal law and policy where appropriate (R. Fike, personal communication, 1985). Consultation is initiated with affected Native American groups who have expressed concern. Reburial, in a tribal cemetery, after study, is possible and depends on the agreement reached during the individual consultation process. At present, "grave goods" are not reburied but are held in an appropriate facility. Each case is unique and handled individually. The United States Forest Service Intermountain Region (Region 4) does not have a burial policy, but like the BLM handles matters on a case by case basis (J. Wylie, personal communication, 1985). Consultation between archaeologists, Native Americans and other concerned individuals seems to be informal and mutually beneficial.

As Winter (1980:120) points out, archaeologists can play an important role in Native American heritage preservation with their professional skills, knowledge and ability to educate the public on the history, value and contributions made by Indians to American society. Archaeologists must make the effort to develop positive working relationships with Native American groups and work together in preserving and perpetuating their culture through mutual understandings. Their history and our understanding of their past culture can only benefit.

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LABORATORY ANALYSIS

by

Colin I. Busby and Donald Hardesty

A field lab that processes and analyzes information should be a required facility for both public and private sector archaeological projects. NPS guidelines (35 CFR 66) call for proper lab facilities and staff to operationalize the requirements of a research design. SOPA institutional guidelines require lab space and facilities adequate for research involving the collection of original field data and/or acquisition of specimens at a level commensurate with a project's particular requirements. However, nowhere do the above guidelines detail or specify what constitutes a proper facility, in a manner similar to that used in museum accreditation assessments. The decision as to what constitutes "adequate" is apparently left to the judgment/discretion of the archaeologist involved.

The lab should be given equal consideration in setting up the research process. Excavation and the preparations made for analysis are equally important in data gathering, reporting and information flow. Lab responsibilities should include:

A. Processing--log-in of field material, cleaning, conservation, preparation for temporary storage, records management of field/lab and photo files, forwarding of appropriate materials to disciplinary specialists and other analysts.

B. Preliminary analysis tasks--sort, weigh, count artifact/ecofact classes according to analytical requirements and specialist needs.

C. Performance of preliminary analyses--e.g., soils analysis (texture, pH, various chemical tests), flotation of sediment samples, and sorting of matrix.

D. Records management--preparation of a catalogue, filing and archiving of field and lab records, and data entry.

E. Data assessment--review of available preliminary results and interaction with ongoing field operations, disciplinary specialists, and outside analysts.

F. Curation--conserve, package collections for permanent repository; prepare necessary documentation for repository archive files.

A project Lab Director should be mandatory and equal in status with the Field Director. Required skills should include a knowledge of both prehistoric and historic material culture (with a specialty in one or the other), computer science, statistics, conservation, collections management experience, and administrative experience. The position should be professional in nature. Duties should include review and supervision of

preliminary classification of artifacts and their initial analysis, supervision of coding and data entry, comparison of data from season to season, intra- and inter-site analysis, and provision of current input to guide on-site progress decisions. The Lab Director should also be responsible for administrative lab actions such as equipment ordering and staffing.

Adequate support personnel should be available for lab staffing including specialized personnel with assigned responsibilities for prehistoric and historic material culture, environmental archaeology, data processing, archival research and other tasks as required.

Field and lab work should progress in parallel to allow the development of feedback from preliminary lab analyses and its use to guide the Field Director in operationalizing the project's research design.

In summary, the field lab should be part of an interactive network that includes processing, analysis and research to facilitate the operationalizing of a project's research design. In this way, the lab's role as a first line analytic activity can be enhanced. For example, interaction among the lab, field archaeologists and historians is critical to historic sites archaeology. Historic artifact identification and classification often require extensive archival research and specialist assistance. The ongoing interpretation of site patterns from field maps, computer analysis of artifact patterns, distribution of structures, and the like may suggest new sources of archival data to the specialist along with new problem areas and explanations. The presentation of these data by the lab may have important implications for the direction to be taken by field archaeologists. To meet these goals, the lab must be on an equal footing with the field work with an adequate allocation of funds, facilities and personnel.

Currently available standards and guidelines do not provide explicit specifications for a field lab nor does SOPA have a category that emphasizes "Laboratory Management or Collections Processing." National standard setting-bodies should establish minimum standards for both archaeological field labs and laboratory directors in light of their importance to research projects. Too often field work takes precedence over the support and analytical services that can be offered by an actively participating lab.

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CURATION

by

Joel C. Janetski

Curational facilities serving Great Basin contract-related archaeology are highly variable in terms of size, affiliation, level of funding, staff, policy, costs of curation and accessibility of collections. The only common thread appears to be that all can be subsumed under the rubric of "public" museums, although administration is variously by private, state or federal agencies. The most critical curational issues in the Great Basin are essentially the same as those presented in the Airlie House Report (McGimsey and Davis 1977:58). These include (1) the absence of an agreed upon set of minimum standards for repositories by either the researchers and administrating agencies or the facilities themselves; (2) the failure, in many cases, of repositories to assess responsible curation fees to insure perpetual care, and the failure of sponsors/developers to understand the need for those fees; (3) the problem of inadequate financial structure to provide secure, informed management and care of the collections held in trust. As might be expected, the situation is not the same in all areas. Nevada, for example, because of the lead by the Nevada State Museum, appears to have brought some consistency to the process of curation in that state. Utah and Oregon, however, are more variable in terms of policies and procedures.

The U.S. Department of Interior (1984), the Department of Agriculture (DeBloois 1982), and the Utah Museum Association (Hannibal, Toomey and Bowman 1984) have recently provided some guidelines on minimum standards for facilities accepting archaeological collections. In the Federal Register (36 CFR 66.3) the Department of Interior offers the following definition of a "qualified institution":

> A qualified institution is one equipped with proper space, facilities, and personnel for the curation, storage and maintenance of the recovered data and materials. The exact nature of the space, facilities and personnel will vary depending on the kinds of data and materials recovered, but in general it is necessary for a qualified institution to maintain a laboratory where specimens can be cleaned, labeled, and preserved or restored if necessary; a secure and fireproof storage facility organized to insure orderly maintenance of materials; a secure and fireproof archive for the storage of photographs, notes, etc.; and a staff capable of caring for the recovered data and material.

To this succinct statement of curational qualifications, Hannibal, Toomey and Bowman (1984) would add that the facility should also have a sound financial structure independent of any fees charged, an efficient information storage and retrieval system, and a written policy on acquisition and de-accessioning logic and procedures. The Bureau of Land Management Procedures for Cultural Resource Use Permits includes a

statement of preference that materials be stored as near to their place of origin as feasible.

In reality, these guidelines set out more an ideal set of standards than a minimum level of requirements. Probably few, if any, of the repositories serving the Great Basin meet all of the above specifications. Nor do the federal agencies administering lands where the majority of the collections are being made examine closely the curation facilities being used to house those collections to see if the federal standards are being met. Requests for project proposals issued by the BLM or Forest Service, for example, state that a contractor must have a written curation agreement with a repository, but little is made of repository qualifications on a project-specific basis.[1]

Despite a growing national concern regarding the proper curation of archaeological collections, Marquardt et al. (1982), Christensen (1979), Ford (1977), and others report that important collections are still in jeopardy due to inadequate and uninformed care. Lindsay et al. (1979), for example, in a study of 20 museums, found a number of problems including cramped conditions, loss of collections and individual specimens, loss of records, inaccessibility of collections due to physical constraints or inadequate records, and inadequate security measures. Other critical problems that plague museums are inability to provide proper care for unstable materials such as bone, wood, and textiles, and a lack of adequate space for analysis and both temporary and permanent storage.

Even in the face of these problems, archaeological collections have grown at a dramatic rate during the 1970s due to the increased activities of private contractors who curate collections with public repositories. Such contractors are required by federal agencies to obtain a curation agreement with a repository prior to the award of a contract. To keep costs down, the contractor may seek the institution with the lowest costs, thereby placing curating institutions in the awkward position of competing for curation contracts.

All of these problems apply in some degree to the curation of archaeological materials in the Great Basin. To provide a basis for comparison, each of the states lying within the Great Basin is briefly discussed in terms of the existing museum system. Specific data on individual museums have been given in preceding chapters which provide state-by-state summaries of the regional data base.

California

The museum situation in California is quite complex. A number of museums in the state currently accept and have a history of collecting archaeological material from the Great Basin. Probably the most important among these are the Lowie Museum of Anthropology at the University of California, Berkeley, the Museum of Man in San Diego, and the Southwest Museum in Los Angeles. Additionally, many of the state-affiliated universities with anthropology/archaeology departments also have collections of archaeological and ethnographic material, including some items from the Great Basin.

The only statewide museum organization is the California Association of Museums (CAM). It represents a cross section of museums in the state, including private, city, county and state institutions, but its membership does not include a significant number of curational facilities. The CAM does sponsor regular workshops for members on topics of importance, such as conservation, to assist in upgrading staff skills and facilities generally. Many museums in California are currently attempting to improve data accessibility through computerizing collections, although few such projects are completed.

Idaho

As in Nevada, the structure of anthropology museums in Idaho is quite crisp and well organized. At the recommendation of the Idaho Advisory Council of Professional Archaeologists and others the state has been divided into three geographical regions and all anthropological material recovered within one of those sections goes to the regional center. Centers include the Museum of Natural History at Idaho State University, Pocatello, the Idaho State Historical Museum affiliated with the Idaho Historical Society at Boise, and the Laboratory of Anthropology at the University of Idaho, Moscow. These three centers receive collections from the northeast, southwest and northern portions of the state respectively. All centers have like collections management, packaging, and records policies. No fees are charged for accepting new materials. None of the centers has a staff conservator. The museum structure is reinforced by the Idaho Museums Association which holds an annual fall meeting.

Nevada

The museum situation in Nevada is fairly well defined. With few exceptions collections obtained from public lands go to the Nevada State Museum in Carson City or one of its extensions. Branches currently exist in Las Vegas and Lost City. Other facilities in the state such as the Museum of Natural History at the University of Nevada, Las Vegas and the Museum of Anthropology at the University of Nevada, Reno accept limited materials on a project specific basis depending usually on project history. The Nevada State Museum is central to museum direction in the state and has made explicit its policies on curation costs, collection acquisition, etc. (see Tuohy 1982). Fees for curation are assessed by all with the standard again set by the Nevada State Museum.

Oregon

The Oregon State Museum of Anthropology, located in Eugene at the University of Oregon, is the lead curational repository in the state. The Oregon State Museum is the official custodian of all archaeological collections from public lands in the state, although the collections may physically reside elsewhere, e.g., at Portland State University in Portland or the Horner Museum or Department of Anthropology at Oregon State University in Corvallis. This policy has been affected recently by state legislation which allows for the use of alternate facilities depending on circumstance. In practice, collections are generally curated at the home institution of the researchers who obtained them, and there is considerable

lag in the process of centralization of records at OSMA. There is no coordinated effort to sort collections among facilities based on geographical origin of the items. Other facilities with some archaeological collections include the Oregon Historical Society in Portland and Eastern Oregon State College in LaGrande. The latter has some Great Basin collections and will accept new materials. Museums in Oregon are represented by the Oregon Museum Association.

Utah

Museums in Utah are tied together primarily by membership in the Utah Museums Association. Of the 100-plus members in this organization only six are actively curating new collections generated by archaeological research and only three of these curate materials from the Great Basin. Five of these museums actively curating derive their primary funding from the state. Three of these are affiliated with state universities while two are administered by the Department of State Parks and Recreation. The last museum, the Museum of Peoples and Cultures (MPC) at Brigham Young University, is privately administered, but is a public museum.

Despite the fact that five out of the six repositories are state affiliated, there is with one exception no formal or informal coordination among these entities. In the case of the State Parks Museums, there is an agreement that individual museums will limit their collections on an areal basis to certain sets of counties. The museums administered by State Parks do not currently charge for curation.

Of the four university-sponsored museums in the state, the Prehistoric Museum in Price does not charge for curation, the Museum of Southern Utah in Cedar City charges under certain circumstances, and the Utah Museum of Natural History in Salt Lake City does not charge but accepts collections only from the State Archaeologist and the University of Utah Department of Anthropology due to space limitations. The Museum of Peoples and Cultures charges for all incoming collections. Fees are various as can be seen in the regional sections of this volume. The Utah Museum of Natural History in Salt Lake City has the best trained staff of any repository in Utah, although it, like others in the state, relies somewhat on consultants for conservation assistance.

Summary

Clearly the curational apparatus serving Great Basin archaeologists varies significantly from state to state. Arrangements for curation can, in some cases, be made opportunistically, while in others curation options are highly structured. Arguments for and against both systems can be made. In general, concerns for reasonable access and stable environments for collections are primary common goals for all facilities, although attaining those goals still eludes the majority of them. One clear obstacle in achieving such objectives is inadequate funding. Massive and diverse collections which were often made during the first half of the century are very expensive to retrieve, re-catalog or catalog for the first time, re-package and re-organize. Such work is required, however, if accessibility and stability are to be achieved. Low budgets prohibit all but a

few facilities from having staff conservators to assist in establishing stable conditions for organic materials and collections generally.

To obtain additional funding for various needs, many institutions are charging both for curation and space and for access to collections. Curation fee schedules often include the term "in perpetuity" which is interpreted by some as "lifetime" (cf. Tuohy 1982:13) or at least "long term" curation (Marquardt et al. 1982). The difficulty encountered when fees are accepted for lifetime care of collections is that the flexibility of the repository in achieving specific collection goals and directions is inhibited. That is, it is difficult to de-accession items whose care has been paid for even though they do not enhance the collection goals of the museum.

In general, the status of curational facilities serving the Great Basin is, as noted at the outset, highly variable: access is good in some places, irregular at others and, at some, costly; conservation guidance is lacking in most cases; coordination at a state level is present in Nevada and Idaho but absent elsewhere; funding is apparently inadequate everywhere. At the heart of much of the inconsistency is the failure by many, especially federal agencies, to perceive curation standards as necessary, or even important. There currently exists no procedure for review of repositories receiving collections from public lands to insure that federal standards (36CFR66.3) are being met; in fact, some local Forest Service, NPS and BLM districts are retaining such collections in warehouses. Until curation standards are prioritized by all, private and public alike, present inadequacies will continue and future research efforts will suffer for it.

Recommendations for improvement in the status quo include: (1) increased cooperation among repositories, especially between those with trained staff and those with untrained staff; and (2) the implementation of some level of review and feedback, perhaps modeled after the Museum Assessment Program of the American Association of Museums. Both of these recommendations could and should be followed in close cooperation with state museums associations. Neither will be successful, however, unless state and Federal agencies become involved and concerned with archaeological collections management and back such recommendations.

Endnote

[1]Curation: One Solution to the Problem (by Richard C. Hanes). The current disposition of artifact collections gathered over the past decade by various Federal agencies in the Great Basin is generally not favorable for long term preservation or future study. Artifactual materials are rapidly accumulating. They offer rich opportunities for study, e.g., for comparing raw materials used in different areas of the Great Basin, for comparing differing technologies and perhaps for establishment of other time diagnostic keys in addition to projectile point forms. The potential contributions that CRM offers in adding to our knowledge of Great Basin prehistory and history is nullified to a certain degree by the informality and disarray of existing collections.

Many collections are housed in "temporary" locations such as office buildings and laboratories. Consequently, records of materials held are minimal and retrieval of most items is difficult and time consuming. In some cases time-sensitive items such as projectile points, pottery sherds and other similar items are curated separately and in a more appropriate manner. As a result of these practices, many collections are all but inaccessible for study and discourage efforts at re-study.

An encouraging exception to the above situation is the materials gathered by the BLM in Nevada. The BLM has maintained a contractual arrangement with the Nevada State Museum in Carson City since 1974. Over $100,000 has been spent on curatorial services provided by the museum including recordation of certain attributes of most items, maintaining catalogues of all entries, preparation of materials for storage and storage in easily accessible drawers for subsequent retrieval for display or study. As a result, entire assemblages, including debitage as well as tools, are readily available for study.

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QUALITY CONTROL

by

Richard C. Hanes

The Airlie House Report (McGimsey and Davis 1977:65) stipulated that archaeological projects initiated by historic preservation requirements must meet specified schedules and explicit contract specifications while offering planning information for subsequent use. This is in addition to meeting common archaeological goals of reporting data gathered from field efforts. In attempting to attain such goals, CRM archaeological projects share many of the same frustrations as those of the archaeological profession at large. Since CRM archaeology operates within a legal framework, unlike the "pure" research element of the archaeological community, certain safeguards have been developed by agencies to address variation in quality of work performed. However, the very real factors of limited work force and funding have strongly influenced the implementation of a comprehensive quality control system. The following discussion describes the status of quality control efforts in CRM archaeology in the Great Basin. The manner in which actual fieldwork is conducted as well as completeness in the presentation of field data and synthesis of the results are the targets of such efforts.

Experience in quality control has shown that reliance upon review of the end products of CRM field projects (the survey and excavation reports), and field monitoring of archaeologists' performance, would not be satisfactory alone. The State Historic Preservation Office (SHPO) staff is the principal reviewer of reports in most of the Great Basin states (Idaho, Nevada, Oregon, and Utah). Reports prepared by contracting archaeologists and submitted to federal or state agencies to fulfill project and antiquities permit requirements are commonly reviewed by the technical staff of those agencies and then forwarded to the SHPO. Some variation does exist in the review process, as in Utah where survey reports are submitted by contractors directly to the SHPO. On the other hand, in California agency review is emphasized over SHPO review. Where agency review is applied, its quality is influenced by the training and experience of agency personnel and the amount of time which can be taken from other tasks. Reports written by agency staff have been at times subjected to in-house review, but because of staff cut-backs and increasing workloads the SHPO is primarily relied upon for such review. In turn, the SHPO receives hundreds of reports in a year from the various agencies and contractors. The ability to review such a large number of reports varies among the states, but in general the volume is too great for each report to be adequately inspected.

No formal mechanism for peer review of major project reports has been established in the Great Basin, and probably will not be any time soon. Professional organizations have been established in Idaho, Utah, Oregon, and Nevada. These are the Idaho Council of Professional Archaeologists (ICPA), Utah Professional Archaeological Council (UPAC), Nevada Council of Professional Archaeologists (NCOPA), and Association of Oregon

Archaeologists (AOA). Though each body has assumed the role of watchdog over developments in the archaeological field in its respective state, none is fully willing to tackle the peer review function. The archaeological community in the Great Basin is perhaps too small and intimate for such a system to be fully effective. Negative reviews have led to bitter disputes and resulted in aversion to further cooperation in the review process in some cases. The only peer review which does occur is on an informal basis when an agency requests members of the community to review a manuscript prior to its publication in an agency series.

Equally frustrating have been attempts to monitor and verify the performance of archaeologists in the field. Success by agencies in monitoring contract archaeologists has been sporadic on a regional basis. Unfortunately, areas experiencing the greatest amount of CRM archaeological work have had the greatest difficulty monitoring its performance. The persons who would normally inspect projects find themselves performing field surveys as well. Consequently, those areas under greatest development pressure witness the least monitoring. Another detriment to reliance on field monitoring as a major facet of quality control is the dilemma of who monitors the agency archaeologists? Many types of projects are surveyed by agency personnel, such as lands cases and range improvements. No mechanism exists for monitoring their field performance. Suspicions arise when agency reviewers become aware that some organizations or individuals consistently discover fewer archaeological sites than others, or that sites once recorded cannot be found again, or that site descriptions do not match observations made by subsequent site visitors.

Because of the lack of capabilities for adequately monitoring fieldwork and reviewing in detail every CRM report that is generated, and because of the situation that most agencies having legal responsibilities are staffed by professional archaeologists, the CRM community has found in recent years that the most effective approach to quality control is the development of explicit standards governing field work and report writing. Archaeologists planning work must be knowledgeable of these standards prior to entering the field. By detailing what is expected of the CRM field archaeologist and the organization's principal investigator, those who appoint the contractors become more fully aware of what the often vague and general federal and state regulations actually require, and they may become more appreciative of the services CRM archaeologists are obligated to provide. The ultimate principle is that explicit and detailed guideliness encourage more consistent, higher quality CRM work.

Standards and guidelines for performing CRM field work have been offered by the archaeological profession and various levels of the federal bureaucracy. Therefore, the history of CRM in the Great Basin has witnessed the development of standards addressing several important questions:

1. Who can perform CRM field work?
2. How does one conduct a field surface survey?
3. What should be recorded, and in what manner?
4. How should the various aspects of a survey be presented in a final survey report (including legal definition of the project area, physical description of the survey area, the nature of previous work in the area and sites known, results of the survey, etc.)?

Fieldwork and Reporting Standards

From 1973 to 1976 when government agencies were initially establishing archaeological staffs, few definitive statements existed outlining what constitutes a professional presentation of data. The Airlie House Report (McGimsey and Davis 1977:64-77) devoted considerable effort to spelling out what should and should not be included in archaeological reports. Considerable attention was given to developing research designs and articulating recovered data with stated research questions and goals. Terse outlines were presented for reports of various kinds including intensive field study and mitigation reports. Not provided by this volume were statements on the proper conduct of archaeological field surveys and alternatives for protecting sites *in situ*.

Since the Airlie House guidance was developed, a number of other statements have been made on the subject. The logic and criteria underlying most of these standards derives from proposed guidelines issued by the National Park Service in January, 1977 wherein the basic elements of acceptable reports are discussed:

> The (data recovery) program should result in a report or reports detailing the reasons for the program, the research design, the methods employed in both field work and analysis, the data recovered, and knowledge or insights gained as a result of the data recovery, with reference to the research design and the research value of the property. The report or reports should meet contemporary professional standards and should be prepared in accordance with the format set forth in Appendix A. [Appendix A presents a very general and brief list of items to include in the report.] (36CFR66.2.7).

Since the publication of those proposed rules, guidance was further elaborated by the Heritage Conservation and Recreation Service in 1980 in an unpublished draft, and most of that document was incorporated into yet another unpublished document distributed by the Advisory Council on Historic Preservation (ACHP) in 1984. The ACHP had found a high level of inconsistency in field survey reports, largely due to the lack of clear guidance from the federal level. The ACHP guidance is issued in the form of "recommendations" for those who prepare reports of archaeological surveys under 35 CFR 800 and related authorities. The 1984 document provides a very detailed outline for reports addressing projects of all sizes. Stressed are careful discussions of methods used in the field and laboratory, project-specific summaries of environments and culture history, and the application of data, even from small projects, to current research questions for the region. These guidelines represent an informal addendum to an earlier publication on the treatment of archaeological properties (ACHP 1980).

The National Park Service in 1983 issued the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (United States Department of the Interior 1983a). However, guidance for field

survey reports is very general and only broad categories of information to be included in a report were outlined. The NPS, the agency charged with development of regulations for historic preservation actions, is mainly concerned with professional qualifications and planning-oriented approaches rather than the project approach.

The archaeological profession has two documents addressing the quality of work found to be professionally acceptable. In 1961, the Society for American Archaeology (SAA) published a very brief statement dictating that field collections should be systematic in nature and reports should include the basic elements of adequate record keeping (SAA 1961). In 1976, the Society of Professional Archaeologists (SOPA) published standards which called for adequate planning for field work, and professional descriptions of collected specimens, the environmental context, and field methods (SOPA 1976). The SOPA standards also described institutional/organizational standards for conducting fieldwork. However, both of these documents offered by the profession fail to define what exactly is professionally acceptable work, or provide any examples of such.

All of the above documents share one basic shortcoming; either they address reporting standards without making reference to professional expectations for the actual field work, or else they are too general on either, giving primarily "motherhood" statements about conduct, without describing what actually constitutes professionally acceptable conduct. The Airlie House Report and the Advisory Council's guidelines are notable for defining proper reporting standards.

In the near absence of explicit definitions of what constitutes adequate identification procedures or reporting standards, the CRM community in each part of the Great Basin has attempted to address these topics in various ways. The fact that much contract archaeology is performed on federally administered lands has resulted in federally developed standards, particularly those of the BLM and U.S. Forest Service, becoming the standards for reporting procedures in certain broad areas.

The BLM in California and Utah and the USFS and BLM in Idaho have established formal agreements with their respective SHPOs specifying certain administrative responsibilities of the two agencies and telling how different types of development projects are to be considered. But none of the agreements address standard survey methods. Where there is no local consensus on survey methods, as in Oregon, decisions are made on a case-by-case basis by agency and contract archaeologists.

To avoid this problem the BLM in Oregon, Idaho and California relies on national-level guidance. The BLM guidelines (USDI 1978) are detailed, specifying that an intensive survey (consisting of adjacent on-foot sweeps no more than 30 m apart) is generally required prior to any ground disturbing activity. Reports are to be commensurate with the level of work and a list of specific types of information is to be provided. No specific format is suggested. Suggested standards for recording site information are also given. The Intermountain Region of the Forest Service has developed a detailed guide for the writing of survey reports, including procedures for determinations of significance and effect for projects conducted on National Forest lands in the region (USDA 1984).

The BLM in Utah and Nevada has also developed more detailed guidelines addressing both field methods and reporting standards for the Great Basin situation (USDI 1982, 1984c). As with the ACHP guidance, specifications for projects relatively small in scope, usually meaning projects not requiring full Environmental Impact Statements, are much more precisely detailed. Items addressed include snow cover stipulations, collection policies, standard crew spacing for pedestrian sweeps through project areas, types of cultural phenomena to be recorded (the two guidances differ on the treatment of isolated finds), types of information to be included in a survey report, and the format of that report. Only broad general guidance is offered for larger projects because of the variable nature of the parameters affecting such projects.

It should be noted that perhaps the most important contribution of these more specific guidelines is that in their development all aspects of conducting CRM archaeology were examined. In Nevada, a series of open discussions among members of the archaeological community was conducted in 1979 and 1980. In Utah, annual meetings attended by agency and contract archaeologists have contributed to the development of federal guidelines in that state. In this way, many of the practices, no matter how minor, that had evolved since the full implementation of CRM in the mid-1970s have been reassessed before incorporation into the more explicitly integrated presentation of the guidelines. The success of developing such a compendium of explicitly stated guides has been demonstrated by the lack of community-wide debate in recent years over the various aspects of how CRM business is to be conducted in the field.

In quality control concerns about Great Basin CRM work, the dichotomy between large and small projects is well founded. Small projects commonly relate to activities whose impacts to cultural resource values can usually be avoided through relocation of facilities. Examples include fence lines, drill pad sites and access roads. These numerous, smaller projects are highly restricted in terms of time, funding and their potential for individually addressing important anthropological concerns. Because of the greater prevalence of small projects, a greater variety of contracting firms, institutions and agency personnel perform the surveys. This variation introduces a broad range of perspectives and different degrees of experience. Besides finding important sites to protect, the importance of these surveys can only be derived from their cumulative contributions. Therefore, the smaller projects need greater standardization for the sake of comparability. The detailed standards for field survey established in Utah and Nevada are designed to substantially reduce variability and steer survey results into comparable forms.

It should be noted that the Utah and Nevada guidances are in the form of recommended minimal standards. Flexibility in application is allowed for the archaeologists in charge in the field based on site visibility factors and other logistical concerns. When deviations from the standards are decided on, documentation of such action and justification of the decision is required in the resulting survey report.

The general health of CRM archaeology in the Great Basin is very good. This condition is primarily reflected in the larger projects undertaken.

Large projects are those that involve project and environmental planning and in which survey is required on large blocks or lengthy linear parcels of land. Examples are large land transactions, power plant construction, and emplacement of pipelines or power transmission lines.

The larger projects offer potential and flexibility for CRM archaeologists to perform in a more creative manner. Such projects may involve large blocks of land, as in the Mt. Hope Exxon project north of Eureka, Nevada, or the Borealis Mine Project near Hawthorne, Nevada; a singularly significant and complex site, such as James Creek Shelter in the Carlin Gold Mining Project area near Elko, Nevada; or a long linear project that transects many environmental zones and leads to the recovery of much information, such as the Intermountain Power Project across southern Utah and Nevada. Comparability in field technique among projects becomes less of a concern in these cases, and the contribution of individual projects becomes paramount. Following the initial field survey of such project areas, usually the agency archaeologist can meet with the developer and contract archaeologist and determine the proper course for the data recovery phase of the project. Data recovery methods can be tailored to available funding and logistical considerations in an efficient manner. Efficiency in this context refers to the best means of recovering the most meaningful data to address research questions for those types of sites involved, given the budgets and time constraints inherent in the project. Obviously, the available funding and the time frame are not given, since they are determined partially by the archaeological salvage requirements developed by the agency following review of the initial survey results. However, all projects have definable limits, based on the overall expenses of the proposed development and time schedules for construction. The negotiation process between the agency and the developer often mediates these conflicting factors.

With the evolution of CRM guidance in these ways, review of reports by the SHPO has become much more expedient. For instance, in Nevada an agreement that the BLM will adhere to its own guidelines means that the numerous small survey reports are reviewed by the SHPO only to the extent of looking for trends or patterned deviations by any of the six District BLM offices. If any such pattern were to develop, then the appropriate office would be contacted and reasons for the persistent divergence discussed. Naturally, large project reports are reviewed in the manner established in 36 CFR 800, either through the procedures of paragraph 800.4 or project memoranda of agreement. The SHPO normally provides feedback to the agencies prior to commencement of the proposed development activity.

Attempts at using existing site information to construct statements on the types and distribution of sites in specific areas have highlighted the lack of comparability among the kinds of site data being recorded and the quality of recordation. As a recent attempt to enhance comparability of site data, the IMACS computer system was developed and adopted in most areas of the Great Basin, excluding Oregon and portions of California. The IMACS system represents a valiant attempt at standardizing site data across the Great Basin. The success of the system will be determined in forthcoming years of use (see Lichty, this volume).

Personnel Standards

Established field standards and guidelines, no matter how detailed, only address a portion of the quality control issues. Detailed guidelines can establish minimum standards of professionally acceptable work and enhance comparability of the results of numerous projects performed by various organizations. However, they must allow flexibility of decision making in the field by the archaeologist in charge so that efficiency and accurateness may be tailored to the multitude of situations which may be encountered.

Consequently, personnel standards have been established governing who may lead CRM field work and report development. Most CRM work in the Great Basin is performed either on federal lands or state lands, or under federal or State requirements. Therefore, the permitting process of the agencies is usually the point at which personnel judgments are made.

The SAA has long played a leading role in establishing standards of professionalism. The SAA Committee on Certification met in 1974 as part of the Airlie House Conference and its report constituted a major contribution in the ultimate development of professional criteria (McGimsey and Davis 1977:97-105).

The origin of that effort stemmed from increased concern by the profession in the 1970s about the quality of work being performed under contract for federal agencies. Consequently in 1973 the SAA Committee for the Recovery of Archaeological Remains set goals to establish a set of guidelines for the preparation of reports and to address questions about the qualifications of individuals responsible for contract work. The Society of Professional Archaeologists (SOPA) was founded in 1976 with one of its formal purposes being "to assist governmental and other organizations, using archaeologists in the course of their activities, to identify those properly qualified for the purpose."

In 1961, the SAA provided a brief statement on the minimum qualifications of a field archaeologist. These included an undergraduate degree and two years of graduate study in addition to two summer field school sessions. The 1976 SOPA standards for a field archaeologist greatly expanded on these requirements by stipulating the need for a graduate degree or equivalency and one year of field experience including a specific combination of periods of experience in survey and excavation field work, laboratory work, and planning and executing projects in a supervisory capacity. In 1977 the NPS issued a draft set of standards which were later incorporated into the 36 CFR 61 regulations and the 1983 Secretary's Standards and Guidelines. These standards are similar to SOPA's except that 16 months rather than 12 months of experience are required.

Applying personnel standards to agency archaeologists and to contracting archaeologists requires separate mechanisms which operate rather independently. The federal permitting system has been most influential in screening contract archaeologists desiring to perform CRM work on public lands and National Forest lands. Regulations implementing the Archaeological Resources Protection Act of 1979 were published in early 1984 (United

States Department of the Interior 1984a). In these regulations, personnel qualifications were provided to guide issuance of ARPA permits by Federal agencies. These permitting standards parallel the standards in the 1983 Secretary's Guidelines and Standards.

Until recently each agency and even different offices within an agency have used independently established criteria for approving or granting permits to contract archaeologists. For instance, in the BLM each state element of the agency has used differing standards for assessing permit applications. Oregon, Idaho and California have operated without stated standards, either formal or informal. Basically, if an organization and its individuals have not displayed performance problems in the past, they have been granted a permit regardless of academic background or experience.

The far northern part of the Great Basin has witnessed very little development pressure, therefore the amount of CRM work under purview of the permitting system has been considerably less there than in Utah and Nevada. Because of the large quantity of CRM contract archaeology in Utah and Nevada resulting from oil and gas activities, military operations, and power plant and transmission line construction projects, explicit standards were established to assess in a fair manner the large number of antiquities permit applications which are filed for those regions. These qualification standards share one significant similarity which distinguishes them from all other documents discussed above. Whereas the professional society and National Federal standards do not distinguish between different levels of archaeological positions, the Utah and Nevada BLM have distinguished between the lead archaeologists of the organizations and the field archaeologists who directly supervise the field work. The standards for the former category roughly correspond to SOPA, NPS and ARPA criteria, but the field supervisor standards differ in two ways. Academically, only an undergraduate degree in a related field is required, but substantial field experience (from 2 to 3 field seasons) in the region must be demonstrated. From a quality control standpoint this differentiation of position standards has been desirable so that control over the persons actually identifying cultural resources and providing first hand evaluations of site characteristics may be maintained.

With the NPS transfer of federal permitting authority via the Department of Interior to each of the BLM State Offices, new standards are being developed. The USFS has always had permitting authority separate from the NPS, even to the extent of having authority delegated to the Forest level in some areas. The Intermountain Region of the USFS has recently joined the BLM in an effort to standardize qualifications so that greater consistency may be attained not only among the different state offices of the BLM, but also between two of the major land managing agencies.

Thus, as the above shows, the permitting process--though disdained by some as simply a bureaucratic hurdle to be contended with--has actually served as an effective tool for quality control of CRM projects in the Great Basin.

Maintaining similar personnel standards for federal agency archaeologists performing equivalent levels of duties has been difficult, but the situation is now much improved. Until recently, qualification standards used by agencies hiring archaeologists were based on criteria developed in the 1950s. Consequently, agency hiring of appropriately qualified archaeologists has at times been hindered by admission to the lists of eligibles of persons who do not meet modern professional minimum criteria. In the Great Basin, most federal archaeologists now do meet the minimum standards of SOPA and NPS, but a main area of complaint still remaining has been the use of seasonal employees to perform field surveys.

The SAA and federal agencies lobbied for several years for new standards. Finally, in 1982 the federal Office of Personnel Management initiated revision of the standards for government archaeologists, and the results were issued in 1983 (USDI 1983b). Within this government framework, all positions rated at a GS-9 level and above are considered to require full professional knowledge.

Appropriately, standards for employment at the GS-9 level now correspond to the SOPA, ARPA, and NPS requirements and this level generally is that at which a permanent full time archaeologist position in the Great Basin is rated. The GS-7 level of government employment now corresponds to the field supervisor qualifications developed by the Utah and Nevada BLM. With the inception of these new standards by the federal government, a more uniform level of quality control standards will be established for agencies dealing with CRM archaeology in the Great Basin.

Almost all of the above-mentioned standards allow for equivalency of experience or training in lieu of graduate academic instruction. Although the equivalency factor allows for highly knowledgeable and capable persons who never pursued graduate study to guide archaeological work and perform the same tasks as formally trained archaeologist, it also undercuts to a certain degree the cohesiveness of the professional standards. This is primarily because of looseness in the definition of equivalency. In the Airlie House Report, it was recommended that considerable discretion be exercised in reviewing qualifications of those whose careers have developed without the required formal educational backgrounds, and of specialists with related training and experience. The federal Office of Personnel Management equates one year of relevant professional experience with one year of graduate training. Seasonal employment at technician levels is not considered professional level experience. Still, the equivalency clause interjects a degree of subjectivity into the permitting and hiring process.

In concluding this section a few observations about region-specific research qualifications will be appropriate. A review of existing professional standards suggests that little attention has been given to the need for archaeologists to possess experience specifically in the geographic region where they intend to perform CRM archaeological work. The standards established by SOPA make no mention of this factor; similarly the Airlie House Report made no recommendations pertaining to it. No national level government document makes mention of this consideration except for the NPS 35CFR66 proposed rules published in 1977. In that document a statement that regional experience is "usually desirable" was included at the end of

the professional qualifications section. This statement was deleted from subsequent publication of the qualifications in 1983. The ARPA regulations issued in 1984 simply state that experience in North American archaeology is required.

In the Great Basin the interjection of a requirement for regional research experience has been accomplished through federal agency Antiquities Permit specifications established locally. The need for regional experience has been clearly demonstrated in CRM studies in the Great Basin over the past decade. The decision of what to record, in addition to what is important and why a site is important are regionally-based decisions derived from the cumulative experience of archaeological studies in the area.

Archaeology in the Great Basin primarily focuses on the semi-nomadic behavior of hunter-gatherers throughout the time span of prehistoric occupation. Deviations from this pattern of regional resource use have been considered when addressing Fremont sites in the eastern portion of the Basin and frontier Anasazi sites in the southern Basin. Consequently, the archaeologist working in the semi-arid desert of the Great Basin has a different perspective on the archaeological record than one working on the Pacific Coast or dealing with the long term sedentary cultures of the Southwest or East.

In the Great Basin, the distribution of artifacts, not necessarily "site" locations, across the landscape has become of paramount importance in the recordation of cultural phenomena. The concept of site preservation is introduced when mitigation measures for imperiled cultural resources include data recovery techniques beyond the initial recordation of observed phenomena. An example of these concerns being incorporated into the field strategy to the fullest is presented by the Nevada policy of formally recording all cultural remains in the field and assigning individual site numbers to each entry, even the isolated artifact. Less stringent measures have been adopted elsewhere, as in Utah where small lithic scatters and isolated finds are noted in the text of survey reports, but associated environmental information are not recorded in depth nor are individual site numbers assigned.

Archaeologists performing field work in the Great Basin must have knowledge of such regionally-based conventions in order to contribute to the body of information that is accruing through the multitude of projects. Therefore, it is important for a CRM organization to offer regional expertise in the Great Basin area for CRM work. The most important locus of that experience should be at the level of the field supervisors. They are responsible on the job for recognizing the range of cultural phenomena that may be encountered and the relevant characteristics that should be recorded and considered in any significance evaluation.

To implement this requirement, the Forest Service and BLM jointly developed new draft personnel qualification standards in January, 1985 to be adopted in the permitting process throughout much of the Great Basin. Two archaeological positions are identified on the federal permits. The first is that of the Project Director, who is normally the archaeologist

most responsible for the organization's performance, significance evaluations and mitigation recommendations. Persons occupying this role must have significant academic qualifications and be knowledgeable of relevant anthropological questions to which newly acquired data may be applied. Professional experience must include four months of experience in the same type of activity as allowed through the permit or four months of experience in the cultural/geographic region. These position qualifications are consistent with the standards referenced above. The second position is that of the Field Supervisor, who is the person normally acting either alone or as a crew chief during field operations. Academic requirements are more lenient, but professional experience must include at least four months in the same kind of activity as that applied for in the cultural/geographic area. The regional expertise requirement is mandatory. Enforcing such standards is seen as yet another quality control measure to enhance CRM contributions in the region.

The above discussion addresses primarily CRM archaeology work performed by agency personnel and contract archaeologists performing under contract with third parties, usually development interests. Some archaeological field work is also performed through contract directly between federal and state agencies and archaeologists.

Agency Contracting

The Federal contracting process is troublesome, potentially hindering the performance of high quality CRM work. Because archaeological field work is largely exploratory in nature, Requests for Proposals (RFPs) by agencies normally contain many uncertainties where the nature of the deposits or complexity of surface patterning may not well be appreciated until more in-depth studies are conducted.

Phasing of work efforts could eliminate some confusion, but complexities in federal procurement practices and limited funding often discourage such an approach. One damaging result of this dilemma is that often the scope of work needed far exceeds the actual dollar amount of the budget and the work is terminated short of its goals with only hopes that further work can be arranged. In such cases the contractor, if interested in the more "pure research" aspects of the project, must continue onward unfunded. In either case the likelihood of a final report, not to mention one of high quality, is jeopardized.

Another aspect of the contracting process which impedes quality work is the policy of some agencies to not provide cost information in their RFPs. The RFPs therefore rely on the technical expertise of their developers in being able to properly assess work rates, cost rates and overhead costs. The field of archaeology has traditionally been research oriented, and the demand for establishing professional estimate standards has been low. The lack of any established professional standards for estimating costs enhances uncertainty and creates wide disparities between RFPs and proposals. Differences in the cost structures of large consultant companies, small businesses and academic institutions, can also create substantial differences in costs. Therefore, the scale of work eventually procured may not be appropriately tailored to the true task.

The greatest danger here is that the contractor may become committed to a greater amount of field work than can be performed within budget, and the final phase of the project, report production, may be compromised to trim expenses.

A final characteristic of agency contracting that has hindered quality in some cases is the restriction of bidding for BLM contracts to small businesses only. Consequently, universities and museums which can frequently offer the greatest amount of regional experience, less expensive labor, and adequate laboratory facilities, are not allowed to perform duties requested by local agency offices.

Conclusion

Experience has demonstrated that the opportunity for performing work which offers new insights into of prehistory does exist in the context of large CRM projects. On the other hand, a goal of CRM has been to derive a cumulative end product from the many small projects it inevitably includes, through the use of regional research designs. Such a desired result appears remote in the Great Basin. The lack of any well formulated regional research designs until recently has posed an obvious obstacle. However, the greatest negative factor inhibiting the correlation and use of small-project site data is the fact that so many different archaeologists have done the work. Any conclusions but the simplest correlational exercises would be very difficult to generate due to disparities in the data. Perhaps the most significant contribution small projects may offer is the occasional discovery of large or uniquely informative sites, rather than the direct pursuit of anthropological inquiry.

Endnote

[1]Quality Control Monitoring of in-house Agency Work (by Thomas J. Green). Monitoring in-house agency work is primarily the job of the State Historic Preservation Office. Federal agencies are required to obtain the comments of the SHPO concerning the level of survey needed to identify archaeological and historic properties, the significance of the properties located in a project area, and the effect of the project on significant properties. If properties eligible for the National Register of Historic Places are adversely effected by a federal project the agency must seek the comments of the Advisory Council on Historic Preservation. The SHPO is a party to any agreements between the Agency and the Advisory Council to mitigate the effects of a project on National Register properties. If Programmatic Memoranda of Agreement have been signed by an agency, the Advisory Council, and the SHPO, then it is frequently the SHPO who negotiates the mitigation measures on a specific project.

The ability of the SHPO to influence the quality of work in an agency is limited by a number of factors. The most important factor is that SHPOs can only comment on federal programs; they have no enforcement authority. If agencies ignore the comments of the SHPO, the SHPO can report it to the Advisory Council which can then investigate to see if the agency is complying with its procedures. The SHPO can also report it to professional

organizations so that they can put pressure on an agency. Other options are also available, but in practice many SHPOs have little recourse if an agency chooses to ignore their comments.

The Secretary of Interior's Standards for Archaeology and Historic Preservation (FR, VOL. 48(no. 190), pp. 44716-44742) are advisory and not regulatory. It is recommended that agencies comply with these standards and most SHPOs recommend compliance, but it is up to the individual manager in an agency to see that the standards are followed. The professional community must help the SHPOs and the agency cultural resource specialists to educate these managers on the importance of archaeological and historic properties.

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DISSEMINATION OF INFORMATION AND PUBLIC AWARENESS

by

Joel C. Janetski

Mechanisms for Dissemination of Information

Publications specifically serving Great Basin anthropological studies include a regional journal, several University or Museum affiliated series, and a number of more local newsletters published by state professional and amateur organizations. Data are also made available to the public via the National Technical Information System (NTIS) which primarily serves federally sponsored projects. To make this chapter meaningful, however, I will focus on regional and state publications.

The single regional professional journal representing the Great Basin is the Journal of California and Great Basin Anthropology currently published by the Malki Museum at the Morango Indian Reservation, Banning, California, in cooperation with the University of California, Riverside. The Cultural Resource Series published by the Bureau of Land Management provides an outlet for manuscripts on important work on BLM lands. These BLM publications are free of charge and cover topics from history to excavation. Other publications are presented on a state by state basis below along with a list of archaeological organizations.

California

Contributions of the University of California Archaeological Research Facility published by the University of California, Berkeley. Contains synthetic reports of archaeological research.

University of California Publications in American Archaeology and Ethnology, published by the University of California, Berkeley. Contains major reports of research in both archaeology and ethnology.

University of California Archaeological Survey Reports, published by the University of California, Berkeley. Mostly technical or descriptive reports of excavation or survey.

Masterkey, published by the Southwest Museum. Masterkey along with the Papers and other series of the Southwest Museum contain a number of reports on Great Basin Archaeology especially.

Matarango Museum Monographs, published by the Matarango Museum.

Ballena Press Monographs in California and Great Basin Anthropology, published by the Foundation for the Publication of Great Basin Anthropology. Published by the Great Basin Foundation in San Diego. The foundation also will be starting two new series, Occasional Papers in 1985, and the Emma Lou Davis Series in Anthropology of the Americas in 1986.

Journal of New World Archaeology, published by the Department of Anthropology at UCLA. This series and a Monograph series occasionally contain issues dedicated to the Great Basin.

SCA Newsletter, published by the Society for California Archaeology, a professional and amateur organization. The Newsletter is issued five times a year.

Newsletter of the Imperial Valley College Museum, published by the Imperial Valley College Museum.

The Quarterly, published by the Pacific Coast Archaeological Society. This is a journal but the Society also publishes a newsletter.

ASA Journals, published by the Archaeological Survey Associates. This amateur group also publishes Occasional Papers and a Bulletin.

Friends of Calico Newsletter, published by the San Bernardino County Museum.

Professional and amateur organizations in California include the Society for California Archaeology (professional and amateur), the Great Basin Foundation (professional), The Pacific Coast Archaeological Society (amateur), Friends of Calico (amateur), and the Archaeological Survey Organization (amateur).

Idaho

Tebiwa, published by the Museum of Natural History at Idaho State University. The publication contains synthetic archaeological and ethnographic papers on the Great Basin and Columbia Plateau regions. Publication is on a manuscript-available basis.

Occasional Papers of the Idaho State University Museum, published by the Museum of Natural History at Idaho State University. These are technical reports of archaeological work, published as needed.

Archaeological Reports, published by Boise State University. Contains both archaeological and ethnographic reports on the northern Great Basin.

Northwest Anthropological Research Notes, published by the University of Idaho in Moscow. This is a semi-annual journal.

Anthropological Research Manuscript Series, published by the University of Idaho. This series reports on technical and contract related archaeological work.

Idaho Archaeologist, published by the Idaho Archaeological Society. Published twice a year, the series contains research notes by both amateur and professional archaeologists. Also supported by the Idaho Advisory Council of Professional Archaeologists.

The two archaeological associations currently active in Idaho are the Idaho Advisory Council of Professional Archaeologists and the Idaho Archaeological Society.

Nevada

The Nevada State Museum Anthropological Papers, published by the Nevada State Museum. Contains primarily synthetic archaeological and some ethnographic material as available.

The Nevada State Museum Occasional Papers, published by the Nevada State Museum. Emphasis is on ethnography with some archaeology.

The Nevada State Museum Popular Series, published by the Nevada State Museum. Some archaeology but emphasis is on history and natural history.

Nevada Archaeological Survey Reporter, published by the Nevada Archaeological Association. Published two or more times a year, the Reporter contains both amateur and professional reports of findings and research.

Desert Research Institute Technical Report Series in Social Sciences and Humanities, published by the Desert Research Institute. Contains reports of archaeological research, published as manuscripts are available.

Nevada Archaeological Newsletter, published by the Nevada Council of Professional Archaeologists. Contains information of interest to members, especially on the cultural resource political scene both local and national.

Nevada archaeological groups include the Nevada Council of Professional Archaeologists, the Nevada Archaeological Association, AmArchs, a local organization serving northern Nevada, and Archeo Nevada, a local amateur group in southern Nevada.

Oregon

University of Oregon Anthropological Papers, published by the University of Oregon in Eugene. These are published on an occasional basis at the rate of about two volumes per year, and contain archaeological and ethnographic material.

Anthropology Newsletter, published by the Department of Anthropology, Oregon State University. A recently organized publication with an archaeological emphasis issued on a manuscript available basis.

Current Archaeological Happenings in Oregon (CAHO), published by the Association of Oregon Archaeologists. This is a quarterly newsletter of state and local interest. The AOA Occasional Papers (a monograph series) is also published, at the rate of about one volume per year.

Screenings, a newsletter published by the Oregon State Archaeological Society.

The primary archaeological organizations in the state include the Association of Oregon Archaeologists and Oregon Archaeologists in Federal Service, both professional organizations, and an amateur group, the Oregon Archaeological Society.

Utah

University of Utah Anthropological Papers, published by University of Utah Press. Publishes synthetic archaeological, linguistic, ethnographic data on a manuscript available basis.

Archaeological Center Reports of Investigations, published at the University of Utah Department of Anthropology. Publishes primarily contract archaeology and related reports.

Museum of Peoples and Cultures Technical Series, published by The Museum of Peoples and Cultures at Brigham Young University. Publishes the contract reports generated by Cultural Resource Management Services and preliminary reports of archaeological research projects of the Museum and Department of Anthropology.

Western Anasazi Reports, published by the Museum of Southern Utah. Contains both descriptive and synthetic reports on contract and other research projects primarily in southwestern Utah, Northwestern Arizona and southern Nevada on a manuscript available basis.

The UPAC News, published quarterly by the Utah Professional Archaeological Council. Contains news of interest to members and the archaeological community including some research news.

Archaeological organizations active in Utah are the Utah Professional Archaeological Council and two amateur groups, the Utah Statewide Archaeological Society and the Utah Archaeological Association. Another group interested primarily in rock art is the Utah Rock Art Research Association.

Publication and Agency Responsibility

Perhaps no issue is more critical to the professional life of an archaeologist than publication, especially synthetic papers or articles on new perspectives that will get him or her a higher rating in the Citation Index. And on a different level, the lifeblood of archaeology generally is tied to the general public's perception of archaeology and its practitioners. That perception is obtained primarily through the various media: television, films and popular written works. Given the importance of publication it is something of a tragedy that for the most part contract archaeologists, who have to bill all of their time to specific projects, are hard pressed to find developers who will pay for either innovative research or the production of synthetic or popular works. As a result CRM archaeologists seldom find the time to generate such products. By far the majority of CRM reports are short, poorly illustrated, technical, descriptive and generally unacceptable for public consumption. There is certainly

some irony in the fact that the failure of CRM to relate its finds to the public and the professional community may ultimately result in less emphasis on adherence to cultural resource-related legislation and eventually less work for contracting archaeologists. This circumstance is at least partially to blame for the schism that some perceive between academic and CRM archaeology.

One attempt to fill the need for some synthetic literature in Great Basin CRM is the Cultural Resource Series funded by the Bureau of Land Management. These publications, however, are intermediate between the typical CRM reports described above, and marketable, public oriented literature; in most cases they are still not appealing to the public. In other areas (e.g., the Southwest) the Forest Service likewise occasionally funds synthetic reports, similar to those of the BLM series, but again they are primarily for archaeologists, not the public.

One solution to the publication problem would be for federal agencies to let periodic contracts to produce popular, public oriented works that would synthesize data from the multitude of archaeological projects accomplished on their respective lands. One such effort, a book on the archaeology of Oregon, has recently been released by the Oregon State Office, BLM (Aikens 1984). Such a synthetic, agency-supported series could be complemented by a developer-funded, project specific publication also oriented to the public. Such reports could be required and budgeted for on large projects only. These reports should contain screened photographs, be legibly duplicated and properly bound. Some funds could be recovered by developers by charging for the reports.

Public Awareness

Vandalism

A major threat to archaeological research everywhere is the destruction of archaeological sites by vandals. Although most visible in the Southwestern Anasazi ruins, vandalism is quite common throughout the Great Basin, where most depredations target dry caves and rockshelters. As is well known, a number of federal statutes make the disturbance of sites on Federal lands illegal, e.g., the Antiquities Act of 1906 and the 1979 Archaeological Resources Protection Act (ARPA). The latter, in fact, raised the level of seriousness of site vandalism from that of a misdemeanor to that of a felony. Despite these laws and similar state laws, and some convictions under ARPA (e.g., SAA Bulletin 1984), vandalism continues at an alarming rate. The problem in southeastern Utah has grown so severe that in the fall of 1984 then Governor Scott Matheson ordered a Task Force investigation of the problem. The findings of that Task Force have revealed the complexity as well as the magnitude and pervasiveness of archaeological vandalism. Because the vandalism problem is not specific to any one region, a recounting of what came out of those meetings seems appropriate.

First, realizing that the vandalism problem required attack from several sides, the Task Force divided itself into four problem-related groups on (1) law enforcement action, (2) possible legislative action, (3) local or community education and involvement options, (4) museum solutions.

These divisions recognize the fact that vandalism of archaeological sites on public lands is criminal but that law enforcement is a short term and very difficult solution. Convictions of ARPA violators have been few to date, partly because of the public perception that pot hunting is not really a serious matter. For many, the relatively recent furor about site destruction represents a change in the rules. In the 1920s, for example, some local people in Utah were actually hired by museum "archaeologists" to loot sites and were paid by the pot for what they brought back. This perception of what archaeologists do has been perpetuated, and the prosecution of pot hunters, but not archaeologists, for digging in sites almost smacks of unfair discrimination by the state and federal governments (cf. Lund 1985).

Clearly the above comments suggest that more than simple law enforcement is needed. More long term solutions are required. One major problem is our tendency to group the weekend arrowhead hunter with the commercial artifact hunter who digs for profit, selling to dealers with nationwide connections. In recognition of this dichotomy the Task Force stated that:

1. People with genuine interests in the prehistory of former inhabitants of this country need to be able to satisfy those interests in legal and non-destructive ways; that is there should be some viable ways in which they could identify and excavate sites.

2. The real culprits, those who are more interested in personal gain than they are in those prehistoric peoples, need to be identified and enforcement measures need to be focused on eliminating the economic viability that their vandalism currently enjoys.

With both short and long term goals in mind the Task Force made the following recommendations:

Federal Agency Actions:

1. Increase funding for on-site enforcement.

2. Balance spending between law enforcement and identification of endangered sites.

3. Funnel law enforcement money through local agencies.

4. Prioritize site documentation, using local supporters, based on anticipated vandalism patterns.

5. Maintain pressure on problems (perhaps by continuation of Task Force).

State Agency Actions:

1. State lands agencies should hire archaeologists.

2. State "Heritage Parks" should be funded for archaeology-involvement programs.

3. The Division of State History should encourage involvement of amateurs in archaeology projects.

4. Native American interests need to be formally considered in archaeological projects.

Legislative Changes:

1. Amend state and federal laws to focus more on illegal trafficking in artifacts than on the diggers. Make it illegal to exchange unprovenienced artifacts.

2. Modify existing tax laws to allow deductions only for provenienced items.

3. Museums should accept only provenienced material.

Finally, this author feels that the Federal Agency Action recommendations are not strong enough. To date the record of BLM and Forest Service attention to vandalism problems is not impressive. There simply is inadequate priority given to preservation of cultural resources by these agencies, as evidenced by the continuing blatant destruction of sites in southeastern Utah even in the face of the Utah Governor's Task Force on Vandalism and a Federal Law Enforcement Vandalism Task Force. Neither of these task forces have been provided with any funds of their own, although media releases have implied otherwise. Perhaps the lesson here is that when little is given, little is to be expected.

Admittedly, much of what the Utah Task Force was concerned with was taking place in the Southwest, but the Great Basin region, with its vast stretches of public lands, is very much subject to federal policy. All concerned with the fate of the cultural resources on those lands--and there are many such concerned individuals in BLM and the Forest Service--must lobby strongly through our political representatives to attain some priority for cultural resource preservation. It can't be expected that these traditionally non-economic resources will achieve parity with grazing, recreation, mineral and timber rights, but more must be done than is currently being done or the loss of sites and their information will continue to accelerate.

Reports to the Public

The importance of communicating archaeological findings to the general public has been mentioned, but cannot be overemphasized. Perceptions of what we are doing, why we are doing it, and what we do with what we find must include some application to the interests of the ordinary person. At the moment, archaeologists generally are not doing very well on this issue. Most popular literature on archaeology is not written by archaeologists. Few regional (statewide, for example) syntheses exist for the Great Basin (see Jennings 1978, Aikens 1984 as exceptions). There is no popular version of the prehistory of the Great Basin, or the archaeology of Nevada, Idaho, etc. (save perhaps the above), written by a professional. In fact, there are few widely distributed professional syntheses of these areas.

Other states (e.g., Colorado, California, Arizona) and other regions (Southwest, Plains) are well ahead of the Great Basin states in assuming the responsibility for synthesizing data for both popular and professional consumption. Certainly some popular literature exists; the Nevada State Museum publishes a Popular Series intended for a more general market, for example, but much more needs to be done.

Public oriented archaeological information on the Great Basin is also scarce in other media, such as films or packaged slide shows.

Summary

Much remains to be done to improve the flow of information from the professional archaeologist to the public sector. The interest level regarding archaeology is high, as evidenced, ironically, by the amount of vandalism going on, and by the good support for amateur organizations. As recommended by the Utah Task Force on Vandalism, formal involvement programs utilizing amateurs in excavation is one positive approach to maintaining broad support for archaeology and legislation related to archaeology.

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PART IV

SUMMARY AND CONCLUSIONS

FINDINGS OF THE SAA REGIONAL CONFERENCE ON GREAT BASIN CRM ARCHAEOLOGY

by

C. Melvin Aikens

The broad range of subject matter and wealth of detail covered in the foregoing pages defies comprehensive summarization; the present remarks, then, are devoted to offering a broad overview of the concerns discussed.

As noted in the introduction to this volume, probably more than in any other part of the conterminous United States public archaeology in the Great Basin has brought about a major expansion of the data base. It is simply true that a very large proportion of the landscape there is in federal ownership, and land management activities carried out under various CRM mandates have fostered and continue to foster much archaeological research. Moreover, the country is open and depositional regimes have been quite stable, making discoverable sites numerous.

The process of state plan development is going on throughout the region, with plans in various stages of completion. The level of funding support for these efforts ranges from unfortunately little to considerable, depending on the state. In general the approach being taken is to identify subregional study areas within state boundaries and explore research needs and plans for each of them; state plans will ultimately emerge, it is projected, as these subregional perspectives are developed and integrated.

Achieving a regional planning perspective for the Great Basin as a whole is still farther off. The present document, the product of an initiative by the Society for American Archaeology, is the first significant effort in this direction. This synthesis, specifically oriented to Great Basin CRM archaeology, is intended to help engage future CRM planning in a comprehensive regional perspective.

Burgeoning data, especially survey data and the collections and records generated by survey, everywhere pose problems of storage and retrieval. This applies to the output of research into both prehistoric and historic archaeology. Dozens of regional repositories now exist throughout the Great Basin, usually connected with universities and museums. Subregional clearinghouses are developing in response to the need for control over <u>what</u> records, collections, and reports are <u>where</u>.

Efforts to computerize site record files are going forward in all the Great Basin states. An effort notable for its ambition, that will be a marvel as hopes for it become fully realized, is IMACS--the Intermountain Antiquities Computer System. This network has subscribers in Utah, Idaho, Wyoming, and Nevada, and bids to make site survey data from a vast region instantly available to computer-savvy researchers. There is no point in dwelling here on the problems inherent in realizing this and similar efforts within the region, because whatever the difficulties, there is no going back. The immensity and continued growth of the data base demands that we go forward.

Geographical and paleoenvironmental considerations have long been central in Great Basin research, strongly influenced as it has been by the early paleoclimatic work of Antevs (1948), and the ecological perspectives of Steward (1938) and Jennings (1957). Data on certain aspects of the contemporary environment have been developed in some abundance by Federal land-managing agencies, though the information is not always wholly suited to the needs and wishes of archaeologists. The base of information on paleoenvironments has been expanded greatly over the last decade by a number of excellent studies (see Pippin, this volume), though of course always there remains more to be done as research problems are defined and redefined.

A recent multi-author volume on Man and Environment in the Great Basin edited by David B. Madsen and James F. O'Connell (1982) offers a quite detailed areal and topical overview of Great Basin archaeology, supported by an excellent bibliography. When the Great Basin volume of the Smithsonian's Handbook of North American Indians appears--probably during 1986--it will provide a detailed history of research and a complete set of detailed subregional summaries and bibliographies (d'Azevedo n.d.). In addition to these efforts, federal agencies have contracted over the past few years for a large number of subregional cultural resource overviews (e.g. Minor, Beckham, and Toepel 1979; Elston and Davis 1979). In the aggregate, these overviews duplicate one another greatly and they are often quite mechanical data summaries rather than interpretive syntheses; but some are signal examples of professional work, and the genre furnishes indispensable background and bibliographic guidance for local CRM operations by land-managing agencies.

Predictive modeling has received a fair amount of attention in the Great Basin. The best-known modeling efforts have focused on the examination of settlement/subsistence systems, in attempts to test models of Great Basin cultural ecology earlier proposed by Steward (1938), Jennings (1957), and Baumhoff and Heizer (1965). These modeling studies were not originally focused on CRM concerns, but they are certainly relevant to CRM for the questions they have posed and the examples they have provided of "how to do it" (e.g., Thomas 1973, 1972; Bettinger 1977, 1978).

Modeling for CRM purposes has largely taken the form of attempts to predict site locations and estimate kinds and densities of sites within defined areas; that is, to provide "sensitivity maps" that will be of use to land managers. These "predictive" efforts are viewed with misgiving by some researchers, but it is clear that analytical approaches based on sampling and modeling are the way of the present and the future in Great Basin CRM research. Both economic sanity and the advancement of scientific understanding demand it. The large-scale effort now under way by a team of Bureau of land Management archaeologists to develop predictive modeling potentials in general will be closely watched in the Great Basin, where the BLM owns most of the land (BLM 1984).

Research designs in the Great Basin generally follow the structure of inquiry outlined in the now-historic Airlie House Report, including: (1) a statement of perspective; (2) a discussion of the existing data base; (3) a statement of research goals and rationale; and (4) a research strategy

(McGimsey and Davis 1977). Hardesty gives a very good capsule summary of Great Basin research orientations in his chapter of the present document:

> Virtually every statement of theoretical perspective is grounded in Stewardian cultural ecology interpreted within a systems framework. The concepts of cultural adaptation and adaptive strategies, environmental and cultural systems, are pervasive. Overall, the explanatory efforts are directed toward understanding "how things worked" in the past--settlement and subsistence systems, lithic technology, interaction spheres, and the like. Time-bound, historical explanation with extensive use of ethnographic models is the prevailing approach, although some attention is being given to time-free, positivistic explanation of the cultural processes involved.

Throughout the Great Basin, a multitude of policies on artifact collection are followed; in some agencies, on some kinds of surveys, artifacts are not collected at all. This has obvious advantages logistically, but many archaeologists rebel at being told to leave behind scientifically informative specimens which seem certain to disappear into the pockets of the army of artifact collectors who spend their weekends roaming the deserts. Where collections are taken, they are made according to different procedures and objectives; there is no uniform national policy on collection that all agencies must observe. Similarly lacking is a uniform policy governing the operation of laboratories for processing field collections, once made.

The excavation and analysis of Native American burials is a sensitive issue that is currently handled using a variety of laws and regulations in the different Great Basin states. There is no uniform policy, but the essence of the various measures is close communication with concerned Native American groups; actions are generally taken on a case-by-case basis, according to individual circumstances.

The status of curation and curational facilities in the Great Basin is aptly summarized by Janetsky in his chapter on Curation (this volume) as:

> . . . highly variable: access is good in some places, irregular at others and, at some, costly; conservation guidance is lacking in most cases; coordination at a state level is present in Nevada and Idaho but absent elsewhere; funding is apparently inadequate everywhere.

Quality control in Great Basin CRM archaeology, given a general insufficiency of funding for detailed formal review and monitoring, and inherent difficulties in sustaining an ongoing system of rigorous peer review, has been creatively effected by the development of explicit standards governing field work and report writing. Most projects are carried out on federal lands, and the quite detailed guidelines of the large land-holders--the BLM and U.S. Forest Service--have tended to become the standards for the bulk of field work.

The agency guidelines are most specific and detailed where they pertain to the conduct of small projects. Because small projects must

derive most of their importance from their cumulative contributions to the data base, they need greater standardization for the sake of comparability. More flexibility is allowed in the conduct of larger projects, as demanded by both scientific and logistical considerations; correspondingly, more attention to project-specific review is the norm.

Qualifications of project personnel also tend to be governed by federal standards; professional qualifications normally come under consideration at both the contracting and permitting stages. Standards for in-house agency archaeologists have also been recently (1983) upgraded and now meet or exceed minimum SOPA, ARPA, and NPS standards at the GS-9 level, where most full-time federal archaeologists are hired in the Great Basin states.

Mechanisms for the dissemination of CRM information in the Great Basin include a regional journal, several monograph series, and a number of newsletters. The great bulk of data generated by CRM is not formally published, however, but exists as reports of very limited distribution. These reports are to be found in agency files and at a few clearinghouses, archives, or SHPOs. Regrettably, however, there is at present no adequate, organized system to guarantee the accessibility of the information so generated to any interested member of the profession.

Very little indeed of the CRM work that is done in the name of the public finds its way into print in a form that would actually be interesting to the average citizen. Many Great Basin archaeologists are convinced of the necessity for better and fuller communication with the general public through appropriate publication. It is especially important to reach in a positive way those members of the general public who actually do take an active interest in the archaeological resource--the artifact collectors. The BLM in Oregon, and the U.S. Forest Service in California, have recently taken positive steps in this direction by publishing or supporting the publication of general works on the archaeology of those two states, intended specifically for the citizen rather than the specialist (Aikens 1984; Chartkoff and Chartkoff 1984).

In sum, Cultural Resource Management archaeology in the Great Basin is generally going quite well, but a number of organizational as well as scientific problems still need attention, as noted above and throughout the pages of this volume. The authors hope that this general stock-taking contributes a clear vision of where the enterprise is at present, and the directions in which it needs to move in the near future.

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